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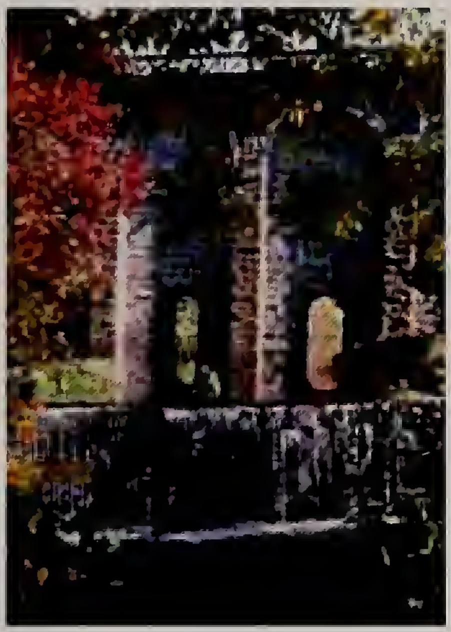
BOSTON HARBOR
1999 WATER QUALITY ASSESSMENT REPORT



Canton Viaduct and Factory Pond on the East Branch

Aberjona River

Boston Light

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BOSTON HARBOR

1999 WATER QUALITY ASSESSMENT REPORT

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Department of Environmental Protection
Division of Watershed Management

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LIST OF ACRONYMS

7Q10	Seven day, ten year low flow
ACEC	Areas of Critical Environmental Concern
ACO	Administrative Consent Order
ACOE	United States Army Corps of Engineers
ANC	Acid Neutralizing Capacity
BDL	Below Detection Limit
BMP	Best Management Practice
BOD	Biological Oxygen Demand
BPJ	Best Professional Judgment
BRP	Bureau of Resource Protection
BUDGETS	Balancing Uses with Demands and Generating Effective Techniques for Sustainability
BWSC	Boston Water and Sewer Commission
CA/T	Central Artery Tunnel (project)
CBOD	Chemical Biological Oxygen Demand
CFU	Colony Forming Unit
CMR	Code of Massachusetts Regulations
CNOEC	Chronic No Observed Effect Concentration
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CWMN	Citizen Water Monitoring Network
CZM	Massachusetts Office of Coastal Zone Management
DDT	Dichlorodiphenyltrichloroethane
DFWELE	Department of Fisheries, Wildlife, and Environmental Law Enforcement
DMF	Division of Marine Fisheries
DO	Dissolved Oxygen
DWM	Division of Watershed Management
DWP	Drinking Water Program
EOEA	Executive Office of Environmental Affairs
EPA	United States Environmental Protection Agency
FPOM	Fine Particulate Organic Matter
FRWA	Fore River Watershed Association
GIS (MassGIS)	Geographic Information System
HABA	Halls Brook Holding Area
I/I	Inflow and Infiltration
LC_{50}	Lethal concentration to 50% of the test organisms
L-EL	Lowest- Effect Level
MA DEM	Massachusetts Department of Environmental Management
MA DEP	Massachusetts Department of Environmental Protection
MassWildlife	Massachusetts Department Fisheries, Wildlife, and Environmental Law Enforcement Division of Fisheries and Wildlife
MDC	Metropolitan District Commission
MDL	Minimum Detection Limit
MDPH	Massachusetts Department of Public Health
MEPA	Massachusetts Environmental Policy Act
MPN	Most Probable Number
MSGRP RI/FS	Multiple Source Groundwater Response Plan Remedial Investigation/Feasibility Study
MWI	Massachusetts Watershed Initiative
MWRA	Massachusetts Water Resource Authority
MyRWA	Mystic River Watershed Association
NAWQA	National Water-Quality Assessment
NCCW	Non-Contact Cooling Water
NECB	New England Coastal Basin
NepRWA	Neponset River Watershed Association
NH_3-N	Ammonia-nitrogen
NPDES	National Pollutant Discharge Elimination System
NON	Notice of Noncompliance
NPS	Non-Point Source
ORW	Outstanding Resource Water
PAH	Polyaromatic Hydrocarbons
PALIS	Pond and Lake Information System
PCB	Polychlorinated Biphenols
PWS	Public Water Supply
QA/QC	Quality Assurance/ Quality Control
QAPP	Quality Assurance Project Plan
RBP	Rapid Bioassessment Protocol
ROD	Record of Decision
SARIS	Stream and River Inventory System
S-EL	Severe Effect Level
SCUBA	Self Contained Underwater Breathing Apparatus

LIST OF ACRONYMS (CONTINUED)

SOP	Standard Operating Procedure
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
SVOC	Semi-Volatile Organic Compound
SWAP	Source Water Assessment Program
SWQS	Surface Water Quality Standards
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TOXTD	MA DEP DWM Toxicity Testing Database
TPH	Total Petroleum Hydrocarbon
TRC	Total Residual Chlorine
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
WBID	Waterbody Identification
WBS	Waterbody System
WMA	Water Management Act
WWTP	Waste Water Treatment Plant
USGS	United States Geological Survey
VOC	Volatile Organic Compound

LIST OF UNITS

cfs	cubic feet per second
cfsm	cubic feet per second per square mile
cfu	colony forming unit
GPM (D)	gallons per minute (day)
MGD	million gallons per day
µg/kg	microgram per kilogram
M	meter
mg/L	milligram per liter
mL/L	milliliter per liter
ng	nanogram
NTU	nephelometric turbidity units
ppb	parts per billion
ppm	parts per million
SU	standard units
TEQ/kg	toxic equivalents per kilogram
µeq/L	microequivalants per liter

EXECUTIVE SUMMARY
1999 BOSTON HARBOR WATERSHED WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. The assessment of current water quality conditions is a key step in the successful implementation of the Watershed Approach. This critical phase provides an assessment of whether or not the designated uses are being met (support, partial support, non-support) or are not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process.

This assessment report presents a summary of current water quality data/information used to assess the status of the designated uses as defined in the Massachusetts Surface Water Quality Standards. Each use, within a given segment, is individually assessed as 1) **support**, 2) **partial support**, or 3) **non-support**. When insufficient current data/information exists or no reliable data are available the use is **not assessed**. However, if there is some indication of water quality impairment, which is not "naturally occurring", the use is identified with an "Alert Status". It is important to note that not all waters are assessed. Many small and/or unnamed rivers and ponds are currently **unassessed**; the status of their designated uses has never been reported to EPA in the Commonwealth's 305(b) Report nor is information on these waters maintained in the Waterbody System (WBS) database.

Mystic River Subwatershed:
There are a total of four rivers, streams, brooks or creeks (the term "rivers" will hereafter be used to include all) assessed in this subwatershed. These include: the Aberjona River, Alewife Brook, the Malden River, and the mainstem Mystic River. These assessments represent 17% of the 24 named streams and approximately 39% (18.75) of the estimated 47.7 river miles in the subwatershed. The remaining rivers are small and/or unnamed, and they are currently unassessed. Two estuarine areas, including the tidally influenced portions of the Mystic and Chelsea rivers and ten lakes, ponds, or impoundments (the term "lakes" will hereafter be used to include all) in the Mystic River Subwatershed are also included. Nearly all of the estuarine area is assessed. Ten lakes assessed in this report represent 381.9 of the 1,482.9 or 26% of the lake acreage in the Mystic River Subwatershed.

Neponset River Subwatershed:
There are a total of 31 rivers and two estuarine areas in the Neponset River Subwatershed (including the mainstem Neponset River, East Branch Neponset River, and numerous tributaries) assessed in this subwatershed. These 31 rivers represent approximately 97% of the 32 named streams and 96% of the estimated 87.1 river miles in the subwatershed. The remaining rivers are small and/or unnamed, and they are currently unassessed. Information on 33 of the subwatershed's 65 lakes is presented in this report. These 33 lakes represent 1,738 of the 1,915 or 91% of the lake acreage in the Neponset River Subwatershed.

Weymouth and Weir Subwatershed:
There are a total of 11 rivers in the Weymouth and Weir Subwatershed assessed in this subwatershed: the Weymouth Back, Weir, Monatiquot, Old Swamp, Crooked Meadow, Mill, Farm, and Cochato rivers and Furnace, Trout, and Town brooks. These 11 rivers represent approximately 30% of the 36 named streams and 55% of the estimated 59.9 river miles in the subwatershed. Four estuarine areas are also assessed. The remaining rivers are small and/or unnamed, and they are currently unassessed. Information on eight of the subwatershed's 27 lakes is presented in this report. These eight lakes represent 373.3 of the 1,204.3 or 31% of the lake acreage in the Weymouth and Weir Subwatershed.

Boston Harbor (Proper):
Eleven estuary segments totaling 47.3 square miles in Boston Harbor (Proper) are assessed in the Boston Harbor (Proper) Subwatershed. These include Boston Inner Harbor, Dorchester Bay, Quincy Bay, Hull Bay, Hingham Bay, Winthrop Bay, Pleasure Bay, and Boston Harbor.

The status of the designated uses for these waterbodies is summarized in a segment format, which includes four river segments, two estuary segments, and ten lake segments in the Mystic River Subwatershed; 31 river segments, two estuary segments, and 33 lake segments in the Neponset River Subwatershed; 11 river segments, four estuary segments, and eight lake segments in the Weymouth and Weir Subwatershed; and 11 estuary segments in Boston Harbor (Proper). The designated uses, where applicable, include: Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation and Aesthetics.

AQUATIC LIFE USE – RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

The Aquatic Life Use is supported when suitable habitat (including water quality) is available for sustaining a native, naturally diverse community of aquatic flora and fauna. Impairment of the Aquatic Life Use (non-support or partial support) may result from anthropogenic stressors that include point and/or nonpoint source(s) of pollution and hydrologic modification.

Mystic River Subwatershed – Aquatic Life Use Summary:

Only one of the 18.75 fresh water river miles assessed in this subwatershed supports the Aquatic Life Use - the Mystic River from the outlet of Lower Mystic Lake to its confluence with Alewife Brook (Figure 1). The Aquatic Life Use is assessed as impaired (non-support) for the lower 6.6 miles of the Aberjona River and the entire length of Alewife Brook. The impairment of the Aberjona River is a result of loss of habitat, an impaired benthic macroinvertebrate community, low dissolved oxygen concentrations, and elevated nutrients. Sources, where known, include hydromodification (channelization), although urban runoff/ storm sewers are also suspected. Alewife Brook is impaired by low dissolved oxygen concentrations, high nutrients, and elevated levels of trace elements in the sediments. Sources include urban runoff/storm sewers and combined sewer overflows (CSO) while illicit sewer connections are suspected as a source of impairment. The lower 2.6 miles of the Aberjona River and the entire Malden River (1.9 miles) are currently not assessed for this use.

Rivers
5.4 miles SUPPORT
8.85 miles NON-SUPPORT
4.5 miles NOT ASSESSED

The Aquatic Life Use is supported for 0.67 square miles of the Mystic River (Figure 1). However, the Island End section of the Mystic River is assessed as non-support due to contaminated sediments from the former Eastern Gas & Fuel Company. The entire area of Chelsea River (locally known as Chelsea Creek) is impaired (non-support) for the Aquatic Life Use due to the negative impacts of metals in the sediments, high levels of turbidity and effects of petrochemical contamination. The sources of impairment include urban runoff/storm sewers, industrial point sources, contaminated sediments, and oil spills.

Estuaries

0.67 square miles SUPPORT
0.53 square miles NON-SUPPORT

Only three of the twelve lakes in the Mystic River Subwatershed are assessed for the Aquatic Life Use (Figure 1). Spy Pond, Arlington is impaired (partial support) due to the presence of the non-native (exotic) Eurasian milfoil *Myriophyllum spicatum*. Winter Pond, Winchester is assessed as partial support due to elevated nutrients. While sources are unknown, urban runoff/storm sewers are suspected. Lower Mystic Lake, Medford is assessed as non-support for the Aquatic Life Use due to unknown causes, organic enrichment/low dissolved oxygen, and salinity. The sources of impairment are unknown, however the lake is a meromictic lake where the noncirculating bottom layer does not mix with the circulating top waters. This noncirculating bottom layer contains saltwater from the estuarine portion of Mystic River that entered the lake prior to the construction of the Amelia Earhart Dam in 1966.

Lakes
120 acres PARTIAL SUPPORT
101 acres NON-SUPPORT
168.9 acres NOT ASSESSED

Neponset River Subwatershed – Aquatic Life Use Summary:

Rivers
25.4 miles SUPPORT
17.8 miles PARTIAL SUPPORT
3.2 miles NON-SUPPORT
39.89 miles NOT ASSESSED

Approximately thirty percent of the 86.29 fresh water river miles assessed in the Neponset River Subwatershed support the Aquatic Life Use (Figure 1). The entire length of four brooks supports this use: Hawes, Traphole, Beaver Meadow, and Pequid. Additionally, the Neponset River from its headwaters at the outlet of Neponset Reservoir, Foxborough to confluence with East Branch, Canton also supports this use. The Aquatic Life Use is assessed as impaired (partial or non-support) for 21 miles in the Neponset River Subwatershed, while 39.89 river miles are currently not assessed.

The entire lengths of Mill, Germany, Meadow, unnamed tributary (locally known as Steep Hill Brook), Beaver, Massapoag, Mother, and Unquity brooks are assessed as partial support (Figure 1). Major issues contributing to the water quality impairment in the Neponset River Subwatershed include low flows and elevated nutrients. Although most sources of impairment are unknown, water withdrawals are suspected to be impacting flows, and contaminated sediments may be contributing to the elevated nutrients and to the benthic community impairments. The East Branch is assessed as non-support due to metals, organic enrichment and unknown causes. The sources of these impairments, where known, include industrial point sources and contaminated sediments. Meadow Brook is also assessed as non-support due to elevated nutrients from a municipal point source (sewers leaking into underdrains).

There are 1.02 square miles of estuarine acreage in the Neponset River Subwatershed, all of which are currently unassessed.

There are 33 lakes totaling 1,738 acres in the Neponset River Subwatershed; none of these support the Aquatic Life Use. Fourteen lakes (1,231 aces) are impaired (partial or non-support) for the Aquatic Life Use due to non-native (exotic) plant infestation (Figure 1). Cobbs Pond, Walpole and Turners Pond, Milton are assessed as non-support due to organic enrichment/low dissolved oxygen and nutrients. Ganawatte Farm Pond, Walpole/Sharon/Foxborough is assessed as non-support due to organic enrichment/low dissolved oxygen and noxious aquatic plants. Sources of impairment to these ponds are unknown, but suspected sources include urban runoff/storm sewers.

Lakes
1218 acres PARTIAL SUPPORT
120 acres NON-SUPPORT
395 acres NOT ASSESSED

Weymouth and Weir Subwatershed – Aquatic Life Use Summary:
The majority (61%) of the 33.2 river miles in the Weymouth and Weir Subwatershed are not assessed. The entire fresh water portion of the Weir River and the Weymouth Back River are assessed as support. The lower 2.0 miles of Old Swamp River (downstream from Mt. Hope Cemetery) are assessed as partial support based on an impaired benthic community from unidentified sources. The Monatiquot River is assessed as non-support due to a moderately impacted benthic community and the loss of habitat due to channelization. While sources of impairment are unknown, sanitary sewer overflows and urban runoff/storm sewers are suspected of contributing organic matter to the stream. Town Brook is assessed as non-support due to habitat alterations (underground and culverted).

Rivers
3.6 miles SUPPORT
2 miles PARTIAL SUPPORT
7.5 miles NON-SUPPORT
20.1 miles NOT ASSESSED

The Weymouth Fore and Weymouth Back rivers are assessed as support for the Aquatic Life Use (Figure 1) representing 78% (5.2 square miles) of the estuarine area in the Weymouth and Weir Subwatershed. The remaining 1.5 square miles are currently not assessed.

Estuaries
5.2 square miles SUPPORT
1.5 square miles NOT ASSESSED

There are a total eight lakes comprising 373.3 acres in the Weymouth and Weir Subwatershed, all of which are currently not assessed for the Aquatic Life Use.

Lakes
373.3 acres NOT ASSESSED

Boston Harbor (Proper) – Aquatic Life Use Summary:
Ninety three percent (43.9 square miles) of the 47.52 square miles assessed in Boston Harbor (Proper) support the Aquatic Life Use. The remaining 3.62 square miles (Pleasure Bay, Hingham Harbor and Hull Bay) are currently not assessed (Figure 1).

Estuaries
43.9 square miles SUPPORT
3.62 square miles NOT ASSESSED

DRINKING WATER USE – RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

The term Drinking Water Use is used to indicate sources of public drinking water. While Drinking Water Use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.state.ma.us/dep/brp/dws/dwshome.htm and from the Boston Harbor Watershed's public water suppliers. These waters are subject to stringent regulation in accordance with the Massachusetts Drinking Water Regulations. MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act. The DWP has also initiated work on its Source Water Assessment Program, which requires that the Commonwealth delineate protection areas for all public ground and surface water sources, inventory land uses in these areas that may present potential threats to drinking water quality, determine the susceptibility of water supplies to contamination from these sources, and publicize the results. Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality), public water suppliers monitor their finished water (tap water) for major categories of contaminants (e.g., bacteria, volatile and synthetic organic compounds, inorganic compounds) and report their data to the DWP.

FISH CONSUMPTION USE – RIVERS, ESTUARIES/ COASTAL EMBAYMENTS, AND LAKES

The Fish Consumption Use is supported when there are no pollutants present that result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2001a). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters. In addition to site specific advisories, in July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination (MDPH 2001b). Because of the statewide advisories, no water can be assessed as either support or partial support for the Fish Consumption Use. MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. The statewide advisories are read as follows:

> The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."
>
> Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)."

Because of elevated levels of contaminants in edible portions of fish, MDPH has issued site-specific fish consumption advisories for five lakes in the Boston Harbor Watershed because of health concerns related to mercury, PCBs, and pesticides. In the Mystic River Subwatershed, this includes Clay Pit Pond. In the Neponset River Subwatershed, these waterbodies include: Bird Pond and Willet Pond (a total of 225 acres). In the Weymouth and Weir Subwatershed, these include: Sylvan Lake and Ice House Pond (a total of 2.7 acres) (MDPH 2001a). The Fish Consumption Use is, therefore, assessed as non-support for these lakes (a total of 227.7 lake acres). MDPH also issued a fish consumption advisory due to PCB contamination for 13.5 miles of the Neponset River from the Hollingsworth and Vose Dam to the Tilestone Dam (MDPH 2001a). The Fish Consumption Use is, therefore, assessed as non-support (Figure 2). The entire length of the Cochato River in the Weymouth and Weir Subwatershed is assessed as non-support for the Fish Consumption Use due to the MDPH advisory for pesticides in fish tissue. Chelsea River, the Mystic River from the Amelia Earhart Dam to the confluence with the Chelsea River, the Neponset River from Milton Lower Falls Dam to Dorchester Bay, Dorchester Bay, Boston Inner Harbor, Quincy Bay, and Boston Harbor (Proper) are assessed as non-support for the Fish Consumption Use due to priority organics (Celona 2001). Because of the statewide advisory, the remainder of the rivers, lakes, and estuaries in the Boston Harbor Watershed default to not assessed for the Fish Consumption Use. Sources of contamination in this area are currently unknown although it is suspected that mercury contamination is due to atmospheric deposition.

Mystic River Subwatershed *Rivers* - 18.75 miles NOT ASSESSED *Lakes*- 376.9 acres NOT ASSESSED 13 acres NON-SUPPORT *Estuaries*- 1.2 square miles NON-SUPPORT
Neponset River Subwatershed *Rivers*- 13.5 miles NON-SUPPORT 72.79 miles NOT ASSESSED *Lakes*- 225 acres NON-SUPPORT 1508 acres NOT ASSESSED *Estuaries*-0.02 square miles NOT ASSESSED 1.0 square miles NON-SUPPORT
Weymouth and Weir Subwatershed *Rivers*- 4 miles NON-SUPPORT 29.2 miles NOT ASSESSED *Lakes*- 2.7 acres NON-SUPPORT 370.6 NOT ASSESSED *Estuaries*- 6.7 square miles NOT ASSESSED
Boston Harbor (Proper) *Estuaries*- 35.82 square miles NON-SUPPORT 11.7 square miles NOT ASSESSED

SHELLFISHING USE – RIVERS, ESTUARIES/ COASTAL EMBAYMENTS

The Shellfishing Use is supported when shellfish harvested from approved Open Shellfish Areas (Class SA) are suitable for consumption without depuration and shellfish harvested from approved Restricted Shellfish Areas (Class SB) are suitable for consumption with depuration. The Division of Marine Fisheries (DMF) classifies shellfishing areas in the Boston Harbor Watershed. The Shellfishing Use for this report was assessed using the DMF shellfishing closure list dated October 2000 (DFWELE 2000). Designated shellfish growing areas (as of October 2000) may be viewed using the MassGIS datalayer available from MassGIS at http://www.state.ma.us/mgis/dsga.htm.

The status of the 6,174.947 acres of shellfishing beds in the Mystic River Subwatershed (including areas that extend into open water and areas not specifically included in this assessment report) is as follows:

DMF Classification Type	**MA DEP Use Support Status**	**DMF Area (acres)**	**% of total DMF acreage**
Conditionally Restricted	Non-support	439.508	7%
Prohibited	Non-support	5,658.649	92%
Management Closure	Not Assessed	76.79	1%

The status of the shellfishing beds in the Neponset River Subwatershed (including areas that extend into open water and areas not specifically included in this assessment report) is as follows:

DMF Classification Type	**MA DEP Use Support Status**	**DMF Area (acres)**	**% of total DMF acreage**
Prohibited	Non-support	476.576	100%

The status of the 26,667.74 acres of shellfishing beds in the Weymouth and Weir Subwatershed (including areas that extend into open water and areas not specifically included in this assessment report) is as follows:

DMF Classification Type	MA DEP Use Support Status	DMF Area (acres)	% of total DMF acreage
Approved	Support	1.567	<1%
Conditionally Restricted	Non-support	1,955.917	7%
Prohibited	Non-support	20,563.160	77%
Management Closure	Not Assessed	4,147.094	16%

The status of the 21,215.25 acres of shellfishing beds (including areas that extend into open-water not specifically included in this assessment report) in the Boston Harbor (Proper) is as follows:

DMF Classification Type	MA DEP Use Support Status	DMF Area (acres)	% of total DMF acreage
Prohibited	Non-support	12,568.984	59%
Management Closure	Not Assessed	8,646.263	41%

Individual DMF management area classifications are provided in Appendix E of this assessment report. It should be noted that their areas are defined in acres of shellfishing habitat.

PRIMARY AND SECONDARY CONTACT RECREATIONAL USES – RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities, pH, temperature, turbidity and aesthetics meet the Surface Water Quality Standards) for any recreational or other water related activity during which there is prolonged and intimate contact with the water with a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. For lakes, macrophyte cover and/or transparency (Secchi disk depth) data are evaluated to assess the status of the recreational uses.

Mystic River Subwatershed –Recreational Use Summary

No waterbodies assessed in the Mystic River Subwatershed support the *Primary Contact Recreational Use.* Alewife Brook and the Mystic River from the outlet of Lower Mystic Lake to the Amelia Earhart Dam are impaired (partial or non-support) for both recreational uses. The lower 6.6 miles of the Aberjona River are impaired for the *Primary Contact Recreational Use* and support the *Secondary Contact Recreational Use.* Sources where known include combined sewer overflows, urban runoff/storm sewers, and industrial point sources. The lower 2.6 miles of the Aberjona River and the Malden River are currently not assessed.

Rivers- Primary Contact Recreational Use
5.4 miles PARTIAL SUPPORT
8.85 miles NON-SUPPORT
4.5 miles NOT ASSESSED
Rivers- Secondary Contact Recreational Use
6.6 miles SUPPORT
5.4 miles PARTIAL SUPPORT
2.25 miles NON-SUPPORT
4.5 miles NOT ASSESSED

Chelsea Creek is assessed as non-support for the *Primary* and *Secondary Contact Recreational* uses due to oil & grease and taste, odor & color. Sources of impairment include multiple oil spills, urban runoff/storm sewers, and industrial point sources. The Island End portion of the Mystic River (0.03 square miles) is impaired (non-support) for both recreational uses due to oil & grease and taste, odor & color from the former Eastern Gas and Fuel Company. Additionally, 0.01 square miles of the Mystic River in the vicinity of the Somerville Marginal CSO Treatment Facility is assessed as non-support due to elevated bacteria counts. The remaining 0.66

Estuaries- Primary Contact Recreational Use
0.66 square miles PARTIAL SUPPORT
0.54 square miles NON-SUPPORT
Estuaries- Secondary Contact Recreational Use
0.66 miles PARTIAL SUPPORT
0.54 miles NON-SUPPORT

square miles of the Mystic River are assessed as partial support due to elevated fecal coliform bacteria counts associated with CSOs.

Only one of the ten lakes in the Mystic River Subwatershed has been surveyed for variables (i.e., bacteria data, macrophyte cover, transparency) used to assess the *Primary Contact Recreational Use*. Winter Pond is impaired (partial support) due to turbidity. While sources of impairment are unknown, urban runoff/storm sewers are suspected. Two lakes (110 acres) support the *Secondary Contact Recreational Use*. The remaining 279.9 acres are currently not assessed.

Lakes- Primary Contact Recreational Use
17 acres PARTIAL SUPPORT
364.9 acres NOT ASSESSED
Lakes- Secondary Contact Recreational Use
110 acres SUPPORT
279.9 acres NOT ASSESSED

Neponset River Subwatershed –Recreational Use Summary
Twelve rivers in the Neponset River Subwatershed support both the *Primary* and *Secondary Contact Recreational* uses. Fecal coliform bacteria data were used to determine that four rivers, totaling 5.1+ miles, did non-support the recreational uses. Germany Brook and the East Branch Neponset River are assessed as non-support for the *Primary Contact Recreational Use*. The Neponset River from the Hollingsworth and Vose Dam to the Tilestone Dam and Mother Brook are also impaired (non-support) for the *Primary Contact Recreational Use*. Seven rivers are impaired (partial or non-support) for the *Secondary Contact Recreational Use*. Sources of contamination, where known, include urban runoff/storm sewers, Sanitary Sewer Overflow (SSO), CSO, and illicit sewer connections/underdrains.

Rivers- Primary Contact Recreational Use
42.6 miles SUPPORT
11.1 miles PARTIAL SUPPORT
15.4 miles NON-SUPPORT
17.19 miles NOT ASSESSED
Rivers- Secondary Contact Recreational Use
51.8 miles SUPPORT
13.1 miles PARTIAL SUPPORT
9.1 miles NON-SUPPORT
12.29 miles NOT ASSESSED

The estuarine portion of the Neponset River is assessed as non-support for both the *Primary* and *Secondary Contact Recreational Use* due to elevated bacteria counts associated with urban runoff/ storm sewers and CSOs. Gulliver Creek is currently not assessed due to the lack of available bacteria data.

Seven of the 33 lakes in the Neponset River Subwatershed were assessed for the recreational uses; none support the *Primary Contact Recreational Use* and only one supports the *Secondary Contact Recreational Use* (Figure 3). With the exception of three lakes (Turners Pond, Milton, Cobbs Pond, Walpole, and Ganawatte Farm Pond, Walpole/Sharon/Foxborough) that DWM sampled in 1999, assessments are based on 1994 macrophyte mapping. Turners Pond in Milton is assessed as partial support for the *Primary Contact Recreational Use* and support for the *Secondary Contact Recreational Use*. The other six lakes are assessed as non-support for both recreational uses due to the presence of non-native (exotic) plant species, noxious aquatic plants, and visual observations of turbidity. Sources of impairment are unknown, but nutrient enrichment from storm water runoff is likely to contribute to increased macrophyte productivity, resulting in impairments to this use.

Lakes- Primary Contact Recreational Use
12 acres PARTIAL SUPPORT
397 acres NON-SUPPORT
1,325 acres NOT ASSESSED
Lakes- Secondary Contact Recreational Use
11 acres SUPPORT
397 acres NON-SUPPORT
1,325 acres NOT ASSESSED

Weymouth and Weir Subwatershed –Recreational Use Summary
The *Primary* and *Secondary Contact Recreational* uses are impaired (partial or non-support) for the entire length of four rivers in the Weymouth and Weir Subwatershed (Figure 3). Old Swamp River is assessed as partial support for both uses while the Monatiquot and Weymouth Back rivers and Town Brook are assessed as non-support. The Weir River is impaired (partial support) for the *Primary Contact Recreational Use* while the *Secondary Contact Recreational Use* is assessed as support. The majority

Rivers- Primary Contact Recreational Use
7.2 miles PARTIAL SUPPORT
8.3 miles NON-SUPPORT
17.7 miles NOT ASSESSED
Rivers- Secondary Contact Recreational Use
2.8 miles SUPPORT
4.4 miles PARTIAL SUPPORT
8.3 miles NON-SUPPORT
17.7 mile NOT ASSESSED

(53%) of the river miles in the Weymouth and Weir Subwatershed are not assessed.

Estuaries- Primary and Secondary Contact Recreational uses
1.9 square miles SUPPORT
3.3 square miles NON-SUPPORT
1.5 square miles NOT ASSESSED

The Weymouth Back River, from the Old Colony Railroad tracks to it mouth between Lower Neck and Wampatuck Road in Hingham, supports both recreational uses. The Weymouth Fore River is assessed as partial support for both the *Primary* and *Secondary Contact Recreational* uses due to elevated bacteria counts. The source of the bacteria contamination is currently unknown, however, SSOs and Smelt Brook Siphon overflows, which are common in this subwatershed, are suspected.

None of the eight lakes in the Weymouth and Weir Subwatershed have been recently surveyed for variables (i.e., bacteria data, macrophyte cover, transparency) used to assess the *Primary* and *Secondary Contact Recreational* uses, therefore, the 373.3 acres of lakes are currently not assessed.

Boston Harbor (Proper) –Recreational Use Summary

Estuaries- Primary and Secondary Contact Recreational uses
33.32 square miles SUPPORT
6.1 square miles PARTIAL SUPPORT
4.7 square miles NON-SUPPORT
3.4 square miles NOT ASSESSED

Seventy percent (33.32 square miles) of the estuarine areas in Boston Harbor (Proper) support both the *Primary* and *Secondary Contact Recreational* uses (Figure 3). Two waterbodies (Boston Inner Harbor and Dorchester Bay) are assessed as partial support for both recreational uses. Pleasure Bay is assessed as partial support for the *Primary Contact Recreational Use*, but supports *Secondary Contact Recreational Use.* Only the Quincy Bay segment that includes Wollaston Beach is assessed as non-support for both recreational uses. This area received direct discharges of storm water and treated sanitary discharge from the former Nut Island Waste Water Treatment Plant (WWTP). The City of Quincy has undertaken extensive projects to survey, repair, and rehabilitate the sewer and storm drain system. The Nut Island discharge is now conveyed through an inter-basin tunnel to the Deer Island WWTP and discharged to Massachusetts Bay.

AESTHETICS USE – RIVERS, ESTUARIES/COASTAL EMBAYMENTS, LAKES

The Aesthetics Use is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

Mystic River Subwatershed –Aesthetics Use Summary

One mile of the Mystic River, from the outlet of Lower Mystic Lake to the confluence with Alewife Brook, and the lower 6.6 miles of the Aberjona River support the *Aesthetics Use* (Figure 4). Alewife Brook and the Malden River are assessed as non-support for the *Aesthetics Use* due to objectionable deposits, trash & debris, taste, odor, & color, and oil & grease. Sources include urban runoff/storm sewers and CSOs.

Rivers
7.6 miles SUPPORT
4.15 miles NON-SUPPORT
7 miles NOT ASSESSED

Estuaries
0.53 square miles NON-SUPPORT
0.67 square miles NOT ASSESSED

Chelsea River is a designated port area and its banks are home to numerous oil tank farms. The entire length of the river is assessed as non-support for the *Aesthetics Use* due to oil & grease, taste, odor & color, and trash & debris. Turbidity is also suspected. Sources of impairment include urban runoff/storm sewers, industrial point sources, spills, and CSOs. The Island End portion of the Mystic River is also assessed as non-support due to noxious odors and sheens emanating from contaminated sediments. The source of this impairment is an industrial point source, the former Eastern Gas & Fuel Company.

Winter Pond and Lower Mystic Lake are assessed as support for the *Aesthetics Use* (Figure 4). No current information is available to assess the remaining lakes in this subwatershed.

Lakes
110 acres SUPPORT
271.9 acres NOT ASSESSED

Neponset River Subwatershed – Aesthetics Use Summary
In the Neponset River Subwatershed, 53% of the river miles support the *Aesthetics Use* (Figure 4). Seven segments are impaired (partial or non-support) for this use. Trash & debris and taste, odor & color associated with storm water runoff are the most common cause of impairment in this subwatershed.

Rivers
46.1 miles SUPPORT
14.2 miles PARTIAL SUPPORT
5.8 miles NON-SUPPORT
20.19 miles NOT ASSESSED

The estuarine area of the Neponset River is impaired (partial support) for the *Aesthetics Use* due to poor water clarity (turbidity) and trash and debris associated with urban runoff/storm sewers. Gulliver Creek is currently not assessed.

Only seven of the lakes in the Neponset River Subwatershed are assessed for the *Aesthetics Use* (Figure 4). Only Turners Pond in Walpole supports the Aesthetics Use. Six lakes are impaired (non-support) for this use due to noxious aquatic plants, non-native (exotic) plants, and/or turbidity. Sources of impairment are currently unknown, but nutrient inputs from storm water runoff most likely contribute to increased macrophyte growth.

Lakes
11 acres SUPPORT
397 acres NON-SUPPORT
1,325 acres NOT ASSESSED

Weymouth and Weir Subwatershed – Aesthetics Use Summary
Due to too little current information, the majority of the Weymouth and Weir Subwatershed (8 rivers, three estuarine areas, and all eight lakes) is currently not assessed for the *Aesthetic Use* (Figure 4). The *Aesthetics Use* is assessed as support for the 11.5 river miles and the estuarine area of the Weymouth Back River downstream from the Old Colony Railroad tracks.

Boston Harbor (Proper) – Aesthetics Use Summary
73 % of the estuarine areas (34.6 square miles) in Boston Harbor (Proper) support the *Aesthetics Use* (Figure 4). Dorchester Bay is impaired (partial support) for the *Aesthetics Use* due to objectionable deposits of trash and debris associated with storm water runoff. 8.32 square miles (17%) are currently not assessed for this use.

RECOMMENDATIONS – Rivers, Estuaries/Coastal Embayments, and Lakes

In addition to specific issues for the individual segments, the evaluation of current water quality conditions in the Boston Harbor Watershed has revealed the need for the following:

- Conduct a preliminary analysis to prioritize the need for collecting quality-assured data to fully assess all designated uses of segments in the Boston Harbor Watershed. Follow the strategy presented in the United States Geological Survey (USGS) Statewide Water-Quality Network Report for examples of the monitoring necessary to completely assess all uses (USGS 2001).

- Inspections should be conducted of facilities with general storm water permits to determine if storm water protection plans have been developed and implemented.

- Conduct in lake monitoring (e.g., fecal coliform bacteria, Secchi disk depth) to assess the Primary and Secondary Contact Recreational uses and collect water chemistry data (e.g., dissolved oxygen and temperature profiles, total phosphorus, chlorophyll a) to assess the Aquatic Life Use. Conduct all monitoring under an approved quality assurance project plan (QAPP). As part of any lake water quality evaluation, include mapping of macrophyte cover in order to evaluate the status of the Aquatic Life, Recreational and Aesthetic uses.

- Track the progress of illegal sewer connection identification and removal programs being implemented throughout the Boston Harbor Watershed.

- Track the progress of storm water management plans and implementation of best management practices as required under the National Pollutant Discharge Elimination System (NPDES) permitting program.

- Work with local citizens, watershed associations, and the EOEA Team to remove/reduce the trash and debris through the Boston Harbor Watershed and support the Boston Harbor Marine Debris Salvage Program

- Track the progress of sewer separation projects being conducted by the Massachusetts Water Resource Authority (MWRA) and the municipalities throughout the Watershed. Conduct bacteria monitoring to determine the effectiveness of these projects.

- Track the progress of CSO abatement projects in the Mystic River Subwatershed and Boston Harbor Proper and conduct bacteria monitoring to determine the effectiveness of these projects.

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BOSTON HARBOR WATERSHED
AQUATIC LIFE USE ASSESSMENT SUMMARY
RIVERS AND ESTUARIES/COASTAL EMBAYMENTS

Details of *Aquatic Life Use* Impairments of river and estuary segments in the Boston Harbor Watershed

MYSTIC RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA71-01	Not Assessed upper 2.6 miles NON-SUPPORT lower 6.6 miles	Organic enrichment/low DO, other habitat alterations, unknown (Urban runoff/storm sewers)
MA71-03	NON-SUPPORT 0.03 square miles SUPPORT 0.67 square miles	Priority organics, PAHs, metals, other inorganics (Contaminated sediments)
MA71-04	NON-SUPPORT	Organic enrichment/low DO, nutrients, metals (Urban runoff/storm sewers, CSO Suspected: Illicit sewer connections)
MA71-06	NON-SUPPORT	Priority organics, unknown, metals, turbidity (Urban runoff/storm sewers, industrial point sources, contaminated sediments, spills)

NEPONSET RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA73-05	NON-SUPPORT	Unknown, metals, organic enrichment (Unknown, industrial point source, contaminated sediments
MA73-08	PARTIAL SUPPORT	Unknown, flow alteration (Unknown, Suspected: water withdrawal)
MA73-15	PARTIAL SUPPORT	pH, nutrients (Unknown)
MA73-19	PARTIAL SUPPORT	Unknown, low flow (Unknown)
MA73-21	PARTIAL SUPPORT	Unknown, nutrients, low flow (Unknown)
MA73-26	PARTIAL SUPPORT	Nutrients, habitat alteration, low pH (Hydromodification, unknown Suspected: urban runoff/storm sewers)
MA73-28	PARTIAL SUPPORT	Organic enrichment/low DO, nutrients, flow alteration (Unknown, hydromodification Suspected: urban runoff/storm sewers)
MA73-32	PARTIAL SUPPORT	Unknown, nutrients, pH (Unknown)
MA73-33	NON-SUPPORT	Nutrients (Municipal point source -illicit connections/underdrains)

WEYMOUTH AND WEIR SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA74-03	Not Assessed upper 2.4 miles PARTIAL SUPPORT lower 2.0 miles	Unknown (Unknown; Suspected: SSO)
MA74-08	NON-SUPPORT	Unknown, habitat alteration (Unknown, Hydromodification Suspected: SSO, urban runoff/storm sewers)
MA74-09	NON-SUPPORT	Habitat alteration, unknown (Hydromodification, unknown)

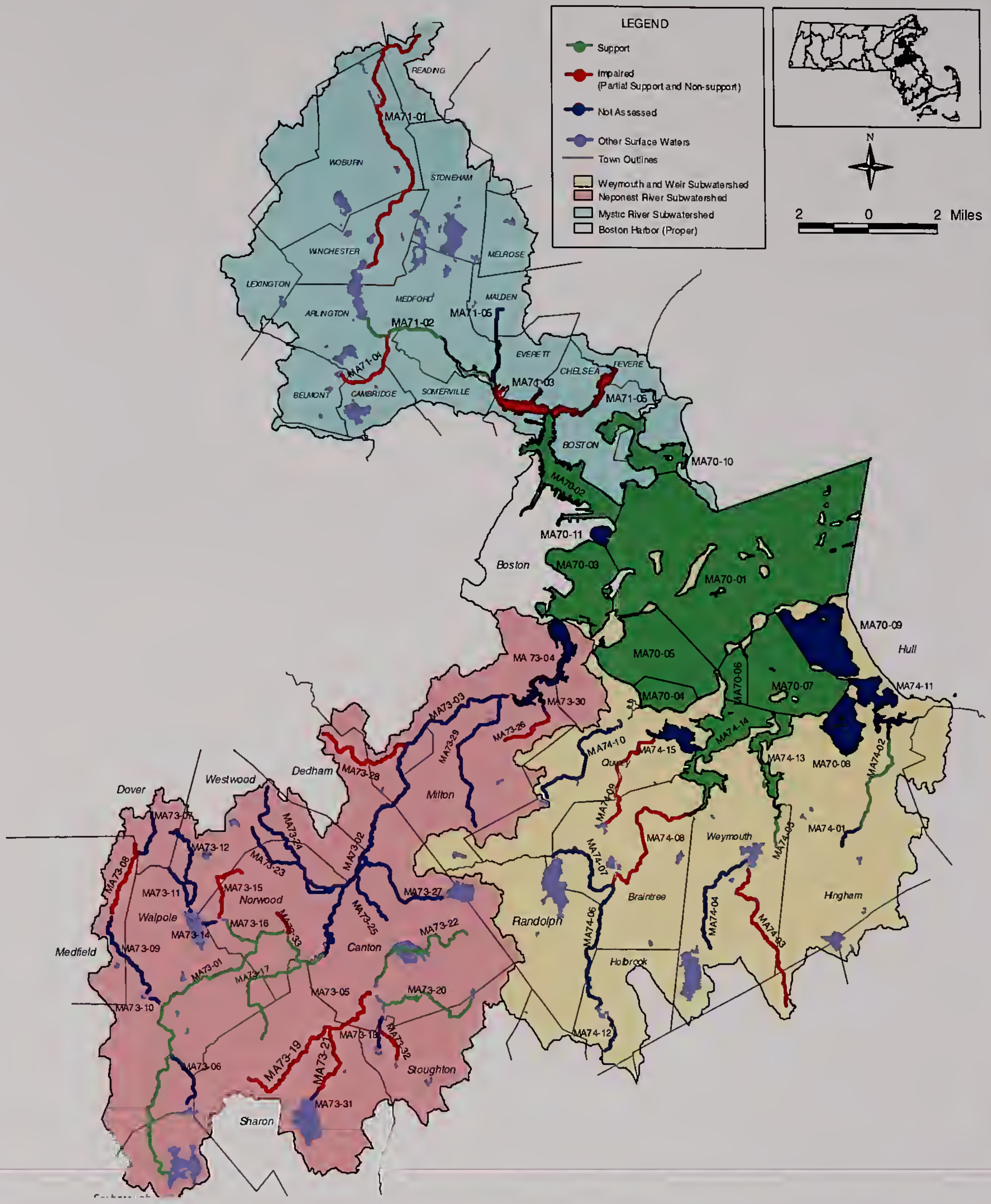


Figure 1. Boston Harbor Watershed *Aquatic Life Use* Assessment Summary-- Rivers and Estuaries

BOSTON HARBOR WATERSHED
AQUATIC LIFE USE ASSESSMENT SUMMARY
LAKES

Details of *Aquatic Life Use* Impairment for Lakes in the Boston Harbor Watershed

MYSTIC RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA71027	NON-SUPPORT	Unknown, organic enrichment/low DO, salinity (salt water)
MA71040	PARTIAL SUPPORT	Exotic Species
MA71047	PARTIAL SUPPORT	Unknown, nutrients

NEPONSET RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA73003	PARTIAL SUPPORT	Exotic species
MA73005	PARTIAL SUPPORT	Exotic species
MA73008	NON-SUPPORT	Exotic species
MA73009	NON-SUPPORT	Organic enrichment/low DO, nutrients
MA73018	PARTIAL SUPPORT	Exotic species
MA73028	PARTIAL SUPPORT	Exotic species
MA73030	PARTIAL SUPPORT	Exotic species
MA73034	PARTIAL SUPPORT	Exotic species
MA73037	NON-SUPPORT	Organic enrichment/low DO, noxious aquatic plants
MA73039	NON-SUPPORT	Exotic species
MA73040	PARTIAL SUPPORT	Exotic species
MA73043	PARTIAL SUPPORT	Exotic species
MA73048	PARTIAL SUPPORT	Exotic species
MA73055	PARTIAL SUPPORT	Exotic species
MA73056	PARTIAL SUPPORT	Exotic species
MA73058	PARTIAL SUPPORT	Noxious aquatic plants, exotic species
MA73059	NON-SUPPORT	Organic enrichment/low DO, nutrients
MA73065	NON-SUPPORT	Exotic species

WEYMOUTH AND WEIR SUBWATERSHED

All lakes in the Weymouth and Weir Subwatershed are currently not assessed for the *Aquatic Life Use*.

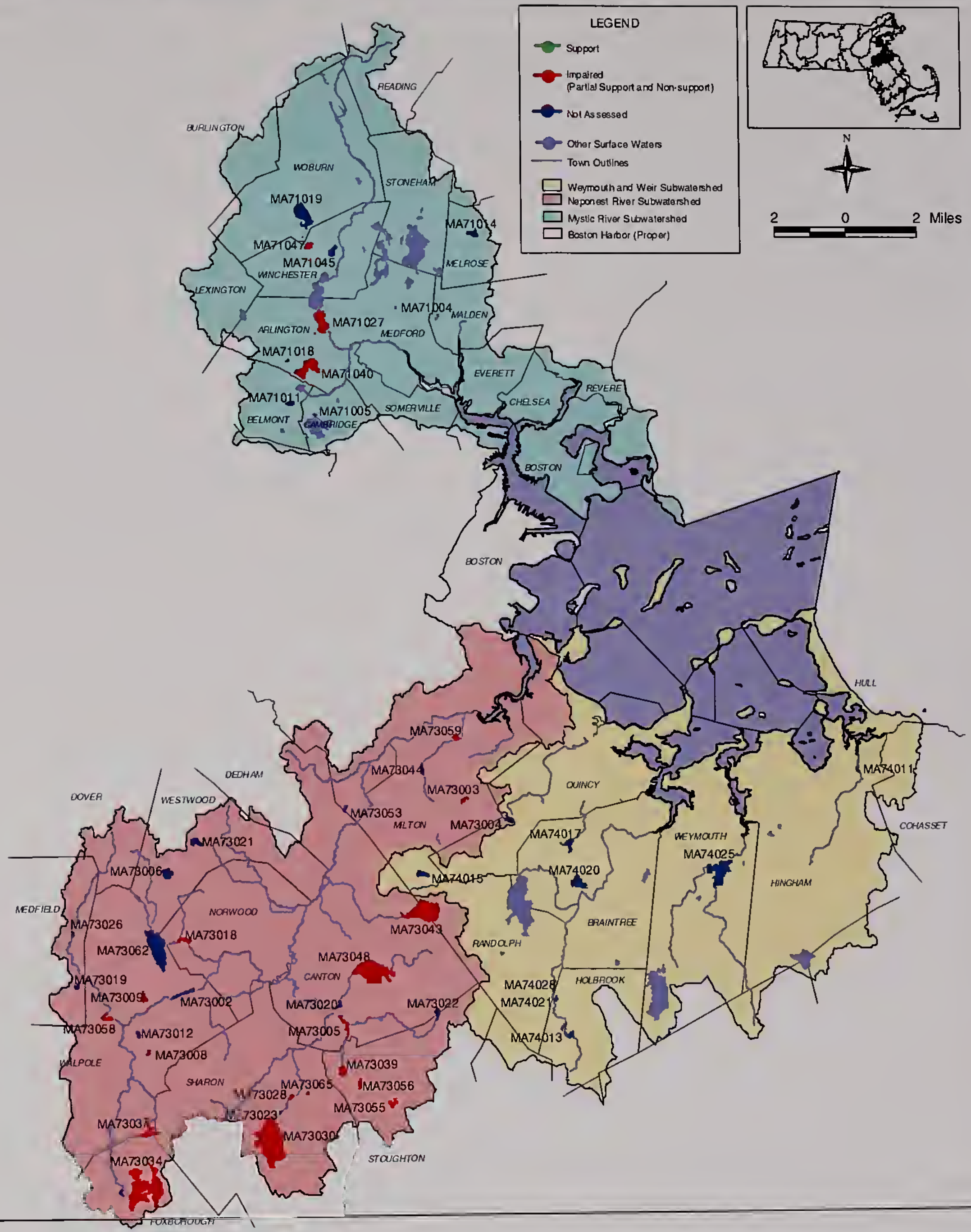


Figure 2. Boston Harbor Watershed *Aquatic Life Use* Assessment Summary— Lakes

BOSTON HARBOR WATERSHED
FISH CONSUMPTION USE ASSESSMENT SUMMARY
RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

In July 2001, the Massachusetts Department of Public Health (MDPH) issued new consumer advisories on fish consumption and mercury contamination (MDPH 2001b).

The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."

Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)."

MDPH's statewide advisory does not include fish stocked by MassWildlife or farm-raised fish sold commercially. The advisory encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* for lakes in the Boston Harbor Watershed cannot be assessed as support or partial support.

MDPH issued five site-specific lake advisories in the Boston Harbor Watershed:

NAME	WBID	CAUSE
Clay Pit Pond	MA71011	Chlordane
Bird Pond	MA73002	PCBs
Willet Pond	MA73062	Mercury
Sylvan Lake	MA74021	Pesticides
Ice House Pond	MA74028	Pesticides

Additionally, MDPH issued site-specific advisories for the following river and estuary segments in the Boston Harbor Watershed:

NAME	WBID	USE ASSESSMENT	CAUSE
Mystic River	MA71-03	NON-SUPPORT	Priority organics
Chelsea River	MA71-06	NON-SUPPORT	Priority organics
Neponset River	MA73-01	Not Assessed upper 9 miles NON-SUPPORT lower 4.7 miles	 PCBs
Neponset River	MA73-02	NON-SUPPORT	PCBs
Neponset River	MA73-03	NON-SUPPORT upper 0.9 miles Not Assessed lower 2.8 miles	PCBs
Neponset River	MA73-04	NON-SUPPORT	Priority organics
Cochato River	MA74-06	NON-SUPPORT	Pesticides
Boston Harbor	MA70-01	NON-SUPPORT	Priority organics
Boston Inner Harbor	MA70-02	NON-SUPPORT	Priority organics
Dorchester Bay	MA70-03	NON-SUPPORT	Priority organics
Quincy Bay	MA70-04	NON-SUPPORT	Priority organics
Quincy Bay	MA70-05	NON-SUPPORT	Priority organics
Pleasure Bay	MA70-11	NON-SUPPORT	Priority organics

All sources of contamination are unknown, although mercury contamination is believed to be due to atmospheric deposition.

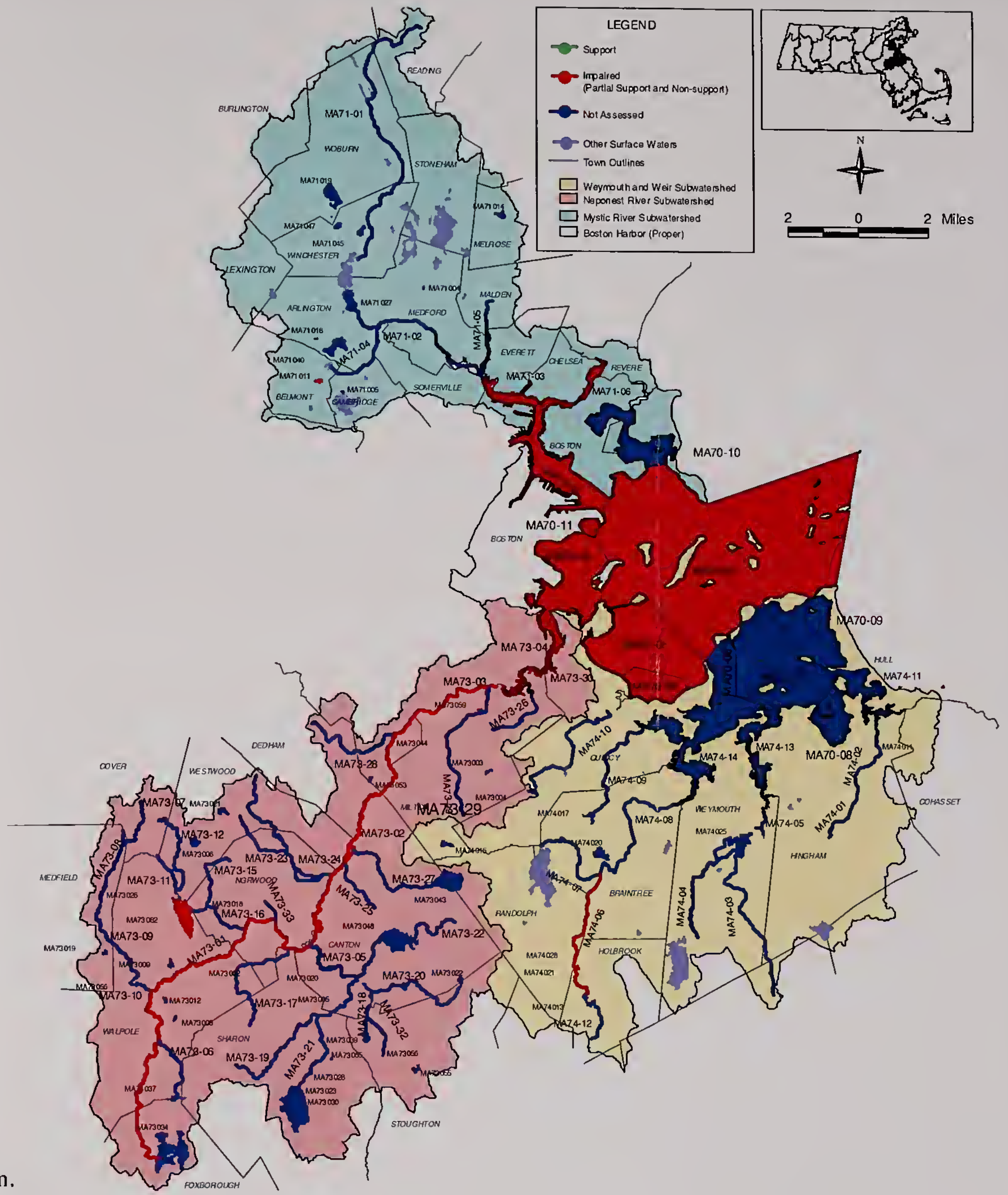


Figure 3. Boston Harbor Watershed *Fish Consumption Use* Assessment Summary—Rivers, Estuaries, and Lakes

BOSTON HARBOR WATERSHED
PRIMARY AND *SECONDARY CONTACT RECREATIONAL USE* ASSESSMENT SUMMARY
RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

Details of Recreational Use Impairments for the Boston Harbor Watershed

1°= Primary Contact Recreation Use
2°=Secondary Contact Recreation Use

MYSTIC RIVER SUBWATERSHED

WBID	Use Assessment	Cause (Sources)
MA71-01	1°- NON-SUPPORT (6.6 miles) 2°- SUPPORT (6.6 miles) 1, 2°-Not Assessed (2.6 miles)	Pathogens (Unknown; Suspected: Illicit sewer connections, waterfowl)
MA71-02	1, 2°- PARTIAL SUPPORT	Pathogens (CSO; Suspected: Urban runoff/storm sewers)
MA71-03	1, 2°- PARTIAL SUPPORT 0.66 square miles 1, 2°- NON-SUPPORT 0.04 square miles	Pathogens (CSO) Pathogens (CSO)
MA71-04	1, 2°- NON-SUPPORT	Pathogens (CSO; Suspected: Illicit sewer connections)
MA71-06	1, 2°- NON-SUPPORT	Pathogens (Oil & grease, taste, odor, & color, unknown, turbidity, pathogens (Urban runoff/storm sewers, industrial point source, spills, CSO)
MA71047	1°- PARTIAL SUPPORT 2°- SUPPORT	Turbidity (Unknown)

NEPONSET RIVER SUBWATERSHED

WBID	Use Assessment	Cause (Sources)
MA73-02	1, 2°- PARTIAL SUPPORT	Pathogens (Urban runoff/storm sewers)
MA73-03	1, 2°- NON-SUPPORT	Pathogens (Urban runoff/storm sewers)
MA73-04	1, 2°- NON-SUPPORT	Pathogens (Urban runoff/storm sewers)
MA73-05	1°- NON- SUPPORT 2°- PARTIAL SUPPORT	Pathogens (Urban runoff/storm sewers) Pathogens (Urban runoff/storm sewers)
MA73-15	1°- NON- SUPPORT 2°- PARTIAL SUPPORT	Pathogens (Urban runoff/storm sewers) Pathogens (Urban runoff/storm sewers)
MA73-16	1°- NON SUPPORT 2°- SUPPORT	Pathogens (SSO)
MA73-26	1, 2°- PARTIAL SUPPORT	Pathogens (Municipal point source, SSO, urban runoff/storm sewers)
MA73-28	1°- PARTIAL SUPPORT 2°- SUPPORT	Pathogens (Urban runoff/storm sewers)
MA73-29	1, 2°- NON- SUPPORT	Pathogens (Illicit connections, municipal point source)
MA73-33	1, 2°- NON- SUPPORT	Pathogens (Illicit connections/underdrains)
MA73009	1, 2°- NON- SUPPORT	Noxious aquatic plants, turbidity (Unknown)
MA73021	1, 2°- NON- SUPPORT	Noxious aquatic plants (Unknown)
MA73034	1, 2°- NON- SUPPORT	1° exotic species, turbidity, 2° Exotic species, (Unknown)
MA73037	1, 2°- NON- SUPPORT	1° Noxious aquatic plants, turbidity, 2° noxious aquatic plants, (Unknown)
MA73039	1, 2°- NON- SUPPORT	Exotic species (Unknown)
MA73059	1°- PARTIAL SUPPORT 2°- SUPPORT	Turbidity (Unknown)
MA73065	1, 2°- NON- SUPPORT	Exotic species (Unknown)

WEYMOUTH AND WEIR SUBWATERSHED

WBID	Use Assessment	Cause (Sources)
MA74-02	1°- PARTIAL SUPPORT 2°- SUPPORT	Pathogens (Unknown)
MA74-03	1, 2°- PARTIAL SUPPORT	Pathogens (SSO)
MA74-05	1, 2°- NON- SUPPORT	Pathogens (SSO)
MA74-08	1, 2°- NON- SUPPORT	Pathogens (Unknown, urban runoff/storm sewers, SSO)
MA74-09	1, 2°- NON- SUPPORT	Pathogens (Unknown; Suspected: Urban runoff/storm sewers)
MA74-14	1, 2°- PARTIAL SUPPORT	Pathogens (SSO)

Boston Harbor (Proper)

WBID	Use Assessment	Cause (Sources)
MA70-03	1, 2°- PARTIAL SUPPORT	Pathogens (CSO)
MA70-05	1, 2°- NON- SUPPORT	Pathogens (Urban runoff/storm sewers, municipal point source)
MA70-10	1, 2°- PARTIAL SUPPORT	Pathogens (Unknown; Suspected: Urban runoff/storm sewers)
MA70-11	1°- PARTIAL SUPPORT 2°- SUPPORT	Pathogens (Unknown; Suspected: Urban runoff/storm sewers)

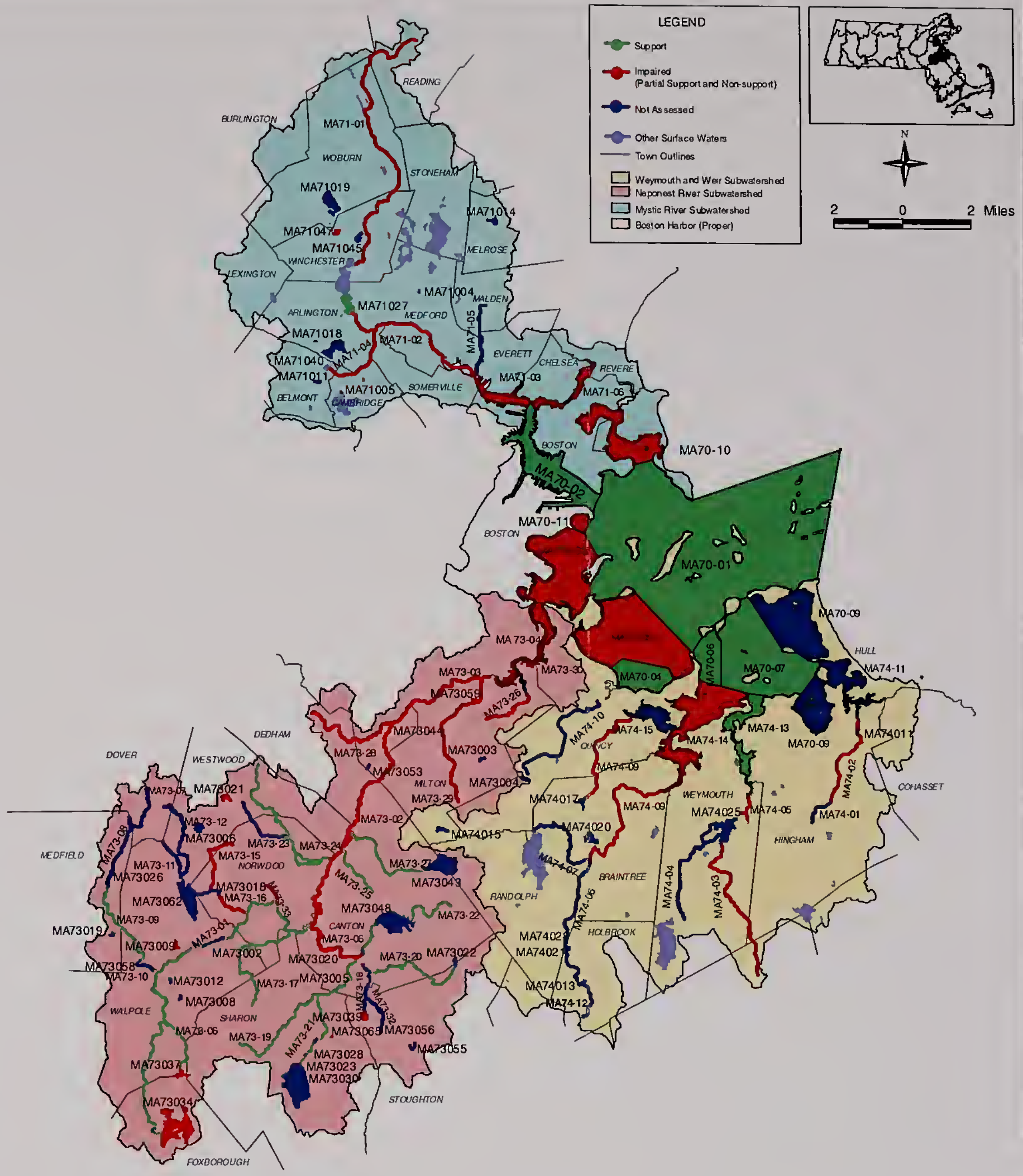


Figure 4. Boston Harbor Watershed *Primary* and *Secondary Contact Recreational Use* Assessment Summary – Rivers, Estuaries, and Lakes

BOSTON HARBOR WATERSHED
AESTHETICS USE ASSESSMENT SUMMARY
RIVERS, ESTUARIES/COASTAL EMBAYMENTS, AND LAKES

Details of *Aesthetics Use* Impairment for the Boston Harbor Watershed

MYSTIC RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA71-03	NON-SUPPORT 0.03 miles Not Assessed 0.67 miles	Odors, oil sheens (Municipal point source)
MA71-04	NON-SUPPORT	Objectionable deposits, taste and odor, oil & grease (Urban runoff/storm sewers, CSO)
MA71-05	NON-SUPPORT	Objectionable deposits, taste and odor, oil & grease (Urban runoff/storm sewers)
MA71-06	NON-SUPPORT	Oil & grease, taste and odor, unknown, trash and debris, turbidity (Urban runoff/storm sewers, industrial point sources, spills, CSO)

NEPONSET RIVER SUBWATERSHED

WBID	Use Assessment	Causes (Sources)
MA73-02	PARTIAL SUPPORT	Trash and debris (Urban runoff/storm sewers)
MA73-03	NON-SUPPORT	Trash and debris (Urban runoff/storm sewers)
MA73-04	PARTIAL SUPPORT	Trash and debris (Urban runoff/storm sewers)
MA73-15	PARTIAL SUPPORT	Color, trash and debris (Urban runoff/storm sewers; Suspected: landfill)
MA73-16	PARTIAL SUPPORT	Trash and debris, odors (Urban runoff/storm sewers)
MA73-26	NON-SUPPORT	Trash and debris, sedimentation (Urban runoff/storm sewers)
MA73-28	PARTIAL SUPPORT	Trash and debris, odors (Urban runoff/storm sewers)
MA73-33	NON-SUPPORT	Taste, odor, and color (Illicit connections/ underdrains)
MA73009	NON-SUPPORT	Noxious aquatic plants (Unknown)*
MA73021	NON-SUPPORT	Noxious aquatic plants (Unknown)*
MA73034	NON-SUPPORT	Exotic species, turbidity (Unknown)*
MA73037	NON-SUPPORT	Noxious aquatic plants, turbidity (Unknown)*
MA73039	NON-SUPPORT	Exotic species (Unknown)*
MA73065	NON-SUPPORT	Exotic species (unknown)*

Boston Harbor (Proper)

WBID	Use Assessment	Causes (Sources)
MA70-03	PARTIAL SUPPORT	Turbidity, suspended solids, trash and debris (CSO)

*A suspected source of lake impairments is urban runoff/storm sewers.

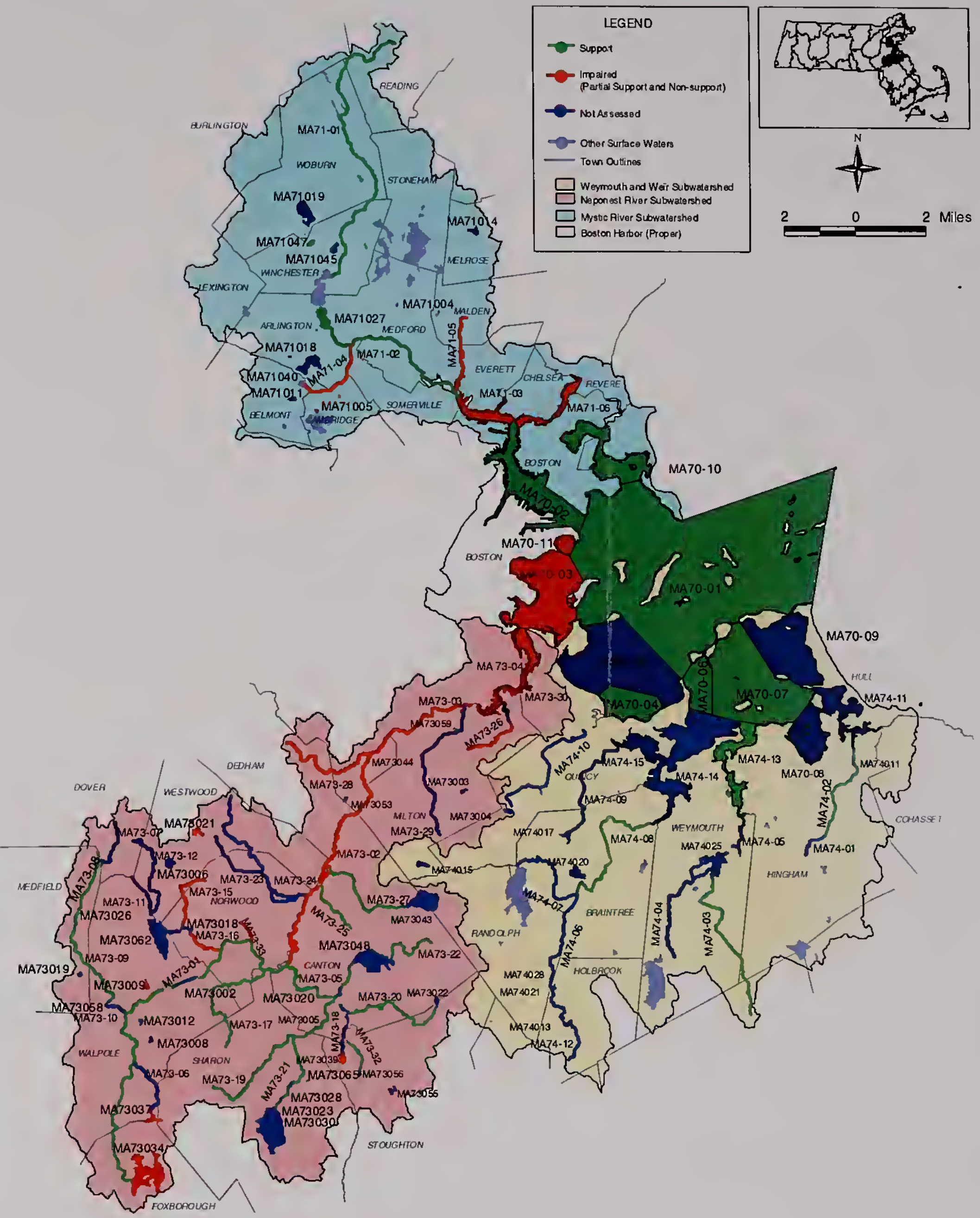


Figure 5. Boston Harbor Watershed *Aesthetics Use* Assessment Summary— Rivers, Estuaries, and Lakes

INTRODUCTION

The Massachusetts Watershed Initiative (MWI) is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the watershed's natural resources can be achieved. Implementation of this project is underway in a process known as the "Watershed Approach". The five-year cycle of the Watershed Approach, as illustrated in Figure 6, provides the management structure to carry out the mission. This report presents the current assessment of water quality conditions in Boston Harbor. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MA DEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle in partial fulfillment of MA DEP's federal mandate to report on the status of the Commonwealth's waters under the Federal Water Pollution Control Act (commonly known as the Clean Water Act).

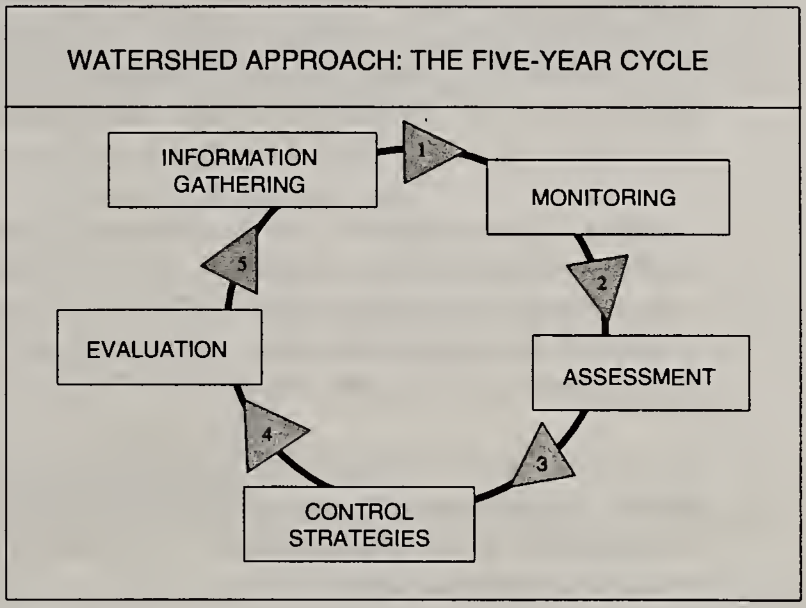


Figure 6. Five-year cycle of the Watershed Approach.

The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, MA DEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the states report on waterbodies within the context of meeting their designated uses (described above in each class).

The 305(b) Report is based on the compilation of information for the Commonwealth's 27 watersheds. It compiles data from a variety of sources and provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level. The most recent 305(b) Report is the *Commonwealth of Massachusetts Summary of Water Quality 2000* (MA DEP 2000a). At the watershed level, instream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). These standards are required by a CWA mandate to be reviewed and revised once every three years. The surface waters are segmented and each segment is assigned to one of the six classes described below. Each class is identified by the most sensitive and, therefore, governing, water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the MA DEP to protect and enhance the designated uses.

Inland Water Classes

1. ***Class A*** *– These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life* and *wildlife,* and *suitable for primary* and *secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW's) under 314 CMR 4.04(3).*

2. ***Class B*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife,* and *for primary* and *secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses* and *for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.*

3. ***Class C*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife,* and *for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking and for compatible industrial cooling* and *process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. ***Class SA*** *– These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary* and *secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*

5. ***Class SB*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife and for primary* and *secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*

6. ***Class SC*** *– These waters are designated as a habitat for fish, other aquatic life, and wildlife and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value.*

A summary of the state water quality standards (Table 1) prescribes minimum water quality criteria to sustain the designated uses. Furthermore these standards describe the hydrological conditions at which water quality criteria must be met (MA DEP 1996). In rivers and streams, the lowest flow conditions at and above which criteria must be met is the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which criteria must be met is the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow which has been agreed upon. In coastal and marine waters and for lakes and ponds the most severe hydrological condition is determined by MA DEP on a case-by-case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA establish a Quality System to support the development, review, approval, implementation, and assessment of data collection operations. To this end, MA DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the Agency are of known and documented quality and are suitable for their intended use (MA DEP 2001a). For external sources of information, DEP requires the following: 1) an appropriate *Quality Assurance Project Plan (QAPP)* including a Quality Assurance/Quality Control (QA/QC) plan, 2) use of a state certified lab (certified in the applicable analysis), 3) data management QA/QC be described, and 4) the information be documented in a citable report.

Table 1. Summary of Massachusetts Surface Water Quality Standards (MADEP 1996). *Note: Italics are direct quotations.*

Dissolved Oxygen	Class A, BCWF*, SA : ≥ 6.0 mg/L and ≥ 75% saturation unless background conditions are lower Class BWWF**, SB: ≥ 5.0 mg/L and ≥ 60% saturation unless background conditions are lower Class C: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge Class SC: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge
Temperature	Class A: ≤ 68°F (20°C) and Δ 1.5°F (0.8°C) for Cold Water and ≤ 83°F (28.3°C) and Δ 1.5°F (0.8°C) for Warm Water Class BCWF: ≤ 68°F (20°C) and Δ3°F (1.7°C) due to a discharge Class BWWF: ≤ 83°F (28.3°C) and Δ3°F (1.7°C) in lakes, Δ5°F (2.8°C) in rivers Class C, SC: ≤85°F (29.4°C) nor Δ5°F (2.8°C) due to a discharge Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) between July through September and Δ 4.0°F (2.2°C) between October through June
pH	Class A, BCWF, BWWF: 6.5 – 8.3 and Δ0.5 outside the background range. Class C: 6.5 – 9.0 and Δ1.0 outside the naturally occurring range. Class SA, SB: 6.5 – 8.5 and Δ0.2 outside the normally occurring range. Class SC: 6.5 – 9.0 and Δ0.5 outside the naturally occurring range.
Fecal Coliform Bacteria	Class A: an arithmetic mean of < 20 organisms /100 mL in any representative set of samples and < 10% of the samples > 100 organisms/100 mL. Class B: a geometric mean of < 200 organisms /100 mL in any representative set of samples and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class C: a geometric mean of < 1000 organisms /100mL, and < 10% of the samples > 2000 organisms/100 mL. Class SA: approved Open Shellfish Areas: a geometric mean (MPN method) of < 14 organisms/100 mL and < 10% of the samples > 43 organisms/100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SB: approved Restricted Shellfish Areas: < a fecal coliform median or geometric mean (MPN method) of 88 organisms/100 mL and < 10% of the samples > 260 organisms /100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SC: < a geometric mean of 1000 organisms/100 mL and < 10% of the samples > 2000 organisms/100mL.
Solids	All Classes: *These waters shall be free from floating, suspended,* and *settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color* and *turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil & Grease	Class A, SA: *Waters shall be free from oil* and *grease, petrochemicals* and *other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil* and *grease* and *petrochemicals.* Class B, C, SB, SC: *Waters shall be free from oil* and *grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A, SA: *None other than of natural origin.* Class B, C, SB, SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants ~	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife… The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.*
Nutrients	*Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.*

*Class BCWF = Class B Cold Water Fishery, ** Class BWWF = Class B Warm Water Fishery, Δ criterion (referring to a change from ambient) is applied to the effects of a permitted discharge. ~ USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.

EPA provides guidelines to the states for making their use support determinations (EPA 1997). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered "historical" and used for descriptive purposes, they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table 1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). Excursions from criteria due to solely "naturally occurring" conditions (e.g., low pH in some areas) do not constitute violations of the standards.

Each designated use within a given segment is individually assessed as 1) ***support***, 2) ***partial support***, or 3) ***non- support***. The term *threatened* is used when the use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data/information exists or no reliable data are available the use is ***not assessed***. In this report, however, if there is some indication that water quality impairment may exist, which is not "naturally occurring", the use is identified with an "Alert Status". Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note, however, that not all waters are assessed. Many small and/or unnamed lakes, rivers, and estuaries are currently ***unassessed***; the status of their designated uses has never been reported to EPA in the Commonwealth's 305(b) Report nor is information on these waters maintained in the Waterbody System (WBS) database.

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996):

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards for freshwater bodies; *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life such as trout, *Warm Water Fishery* - waters which are not capable of sustaining a year-round population of cold water aquatic life, and *Marine Fishery* - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- DRINKING WATER - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

Additionally, there are other restrictions that denote a specific subcategory of use. These restrictions, assigned to a segment, may affect the application of criteria or specific antidegradation provision of 314 CMR 4.00. In the Boston Harbor Watershed these restrictions include:

- Combined Sewer Overflow (CSO) – These waters are identified as impacted by the discharge of combined sewer overflows in the classification tables in 314 CMR 4.06(3). Overflow events may be allowed by the permitting authority without a variance or partial use designation where the provisions 314 CMR 4.06(1)(d)10 are met. The waterbody may be subject to short-term impairment of swimming or other recreational uses, but support these uses through most of their annual period of use; and the aquatic life community may suffer some adverse impact yet is still generally viable).

[Note: The SWQS have "CSO" listed where CSO impacts occur. However, this is only a notation and does not have regulatory significance until all of the provisions of 314 CMR 4.06 (1) (d) 10 have been met (Facilities Plan Approval, Use Attainability Analysis, etc.) and MA DEP makes a formal administrative determination after a public hearing and Massachusetts Environmental Policy Act (MEPA) filing that a B (CSO) designation is supported and appropriate (Brander 2001a).]

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Shellfishing, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MA DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aquatic Life Use*:

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Data available clearly indicates support. Minor excursions from chemical criteria (Table 1) may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** – There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgment (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Exotic plant species present, but not dominant, BPJ	Exotic plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column/Ambient (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
Dissolved oxygen (DO) (3, 6)	Criteria (Table 1)	Criteria exceeded in 11-25% of measurements (surface area for lakes)	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 1)	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) [1]	Criteria (Table 1) [1]	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	Table 1, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4, 12) [2] Chlorine (3, 6) [3]	Criteria (Table 1) 0.237 mg/L NH_3-N [2] 0.011 mg/L total residual chlorine (TRC)[3]	BPJ	Criterion is exceed in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5) [4]	≤ Low Effect Level (L-EL)[4]	One pollutant between L-EL and Severe Effect Level (S-EL)	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	Between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility does not meet their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 μg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 μg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1] maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion, [2] [NH_3-N] at pH = 8.9 SU and 28.3°C, actual "criterion" varies with pH and temperature and is evaluated case-by-case. [3] The minimum quantification level for TRC is 0.05 mg/L. [4] For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCB) in sediment (which varies with Total Organic Carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: The National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500μg/kg wet weight (PPB, not lipid-normalized). PCB data (tissue) in this report are presented in μg/kg wet weight (PPB) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2001a). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters.

In July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."

Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide advisory, however, no waters can be assessed as support or partial support for the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – No restrictions or bans in effect	***Partial Support*** – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	***Non-Support*** – A "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species; or there is a commercial fishing ban in effect
MDPH Fish Consumption Advisory List (8,12)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on MDPH Fish Consumption Advisory List

Other statewide advisories that MDPH has previously issued and are still in effect are as follows (MDPH 2001b):

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCB) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.

Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

DRINKING WATER USE

The Drinking Water Use denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). This use is assessed by DEP's Drinking Water Program (DWP). Below is EPA's guidance used to assess the status (support, partial support, non-support) of the drinking water use.

Variable (# indicates reference)	***Support***-- No closures or advisories (no contaminants with confirmed exceedances of MCLs, conventional treatment is adequate to maintain the supply).	***Partial Support*** – Is one or more advisories or more than conventional treatment is required	***Non-Support*** – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	Reported by DWP	Reported by DWP	Reported by DWP

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.state.ma.us/dep/brp/dws/dwshome.htm and from the Narragansett/Mt. Hope Bay River Watershed's public water suppliers.

SHELLFISHING USE

This use is assessed using information from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (listed below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support –*** SA Waters—Approved[1] SB Waters— Approved[1], Conditionally Approved[2] or Restricted[3]	***Partial Support –*** SA Waters— Conditionally Approved[2], Restricted[3], or Conditionally Restricted[4] SB Waters—Conditionally Restricted[4]	***Non Support –*** SA Waters—Prohibited[5] SB Waters— Prohibited[5] areas
Division of Marine Fisheries Shellfish Project Classification Area Information (11)	Reported by DMF	Reported by DMF	Reported by DMF

NOTE: Designated shellfish growing areas (as of October 2000) may be viewed using the MassGIS datalayer available from MassGIS at http://www.state.ma.us/mgis/dsga.htm.

[1] **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations...." An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

[2] **Conditionally Approved** - "...subject to intermittent microbiological pollution...." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations..." A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

[3] **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

[4] **Conditionally Restricted** - "...subject to intermittent microbiological pollution...." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

[5] **Prohibited** - Closed for harvest of shellfish.

PRIMARY CONTACT RECREATIONAL USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9) *	Criteria met (See Table 1) OR Dry Weather Guidance <5 samples--≤400/100mL maximum Wet Weather Guidance Dry weather samples meet and wet samples ≤2000/100mL	Dry Weather Guidance exceeded in 11-25% of the samples OR Wet Weather Dry weather samples meet and wet samples >2000/100mL	Dry Weather Guidance exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	BPJ, Δ 5 NTU (due to a discharge) exceeded in ≤10 % of the measurements	BPJ, Guidance exceeded in 11-25% of the measurements	BPJ, Guidance exceeded in >25% of the measurements
Secchi disk depth (10) **	Lakes - ≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	BPJ, criteria exceeded 11-25% of the time	BPJ, criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)**	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

**Any portion of a lake exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) is assessed as either partial or non-support. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance, this use is not assessed.

SECONDARY CONTACT RECREATIONAL USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Secondary Contact Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4) *	Dry Weather Guidance <5 samples--≤2000 cfu/100mL maximum >5 samples--≤1000 cfu/100mL geometric mean ≤ 10% samples ≥2000 cfu/100mL Wet Weather Guidance Dry weather samples meet and wet samples ≤4000 cfu/100mL	Wet Weather Guidance Dry weather samples meet (i.e., ≤10% samples ≥2000 cfu/100mL) and any wet samples >4000 cfu/100mL	Criteria exceeded in > 10% of dry weather samples
Oil & Grease (3)	Criteria met (See Table 1)	Criteria exceeded 11-25% of the time, BPJ	Criteria exceeded >25% of the time, BPJ
Aesthetics (3) Biocommunity (4) **	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

** In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

For the *Primary* and *Secondary Contact Recreational* uses the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria counts,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), (Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.)
3. Calculate the % of sample results exceeding 400 cfu/100mL (*Primary*) or 2,000 cfu/100mL (*Secondary*),
4. Determine if the samples were collected during wet or dry weather conditions (review precipitation and streamflow data)
    - Dry weather can be defined as: No/trace antecedent (to the sampling event) precipitation that causes more than a slight increase in stream flow.
    - Wet weather can be defined as: Precipitation antecedent to the sampling event that results in a considerable increase in stream flow.
5. a. Apply the following to interpret dry weather data for *Primary Contact Recreation*:
    - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,
    - 11-25% of the samples exceed criteria (step 2 and/or 3, above) - asses as Partial Support,
    - >25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.

   b. Apply the following to interpret dry weather data for *Secondary Contact Recreation*:
    - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,
    - >10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.
6. Apply the following to interpret wet weather data for *Primary Contact Recreation*:
    - Dry weather samples meet criteria and all wet samples ≤2000 cfu/100mL - assess as Support,
    - Dry weather samples meet criteria and any wet samples >2000 cfu/100mL - assess as Partial Support.
7. Apply the following to interpret wet weather data for *Secondary Contact Recreation*:
    - Dry weather samples meet criteria and all wet samples ≤ 4000 cfu/100mL – assess as Support,
    - Dry weather samples meet criteria and any wet samples > 4000 cfu/100mL – assess as Partial Support.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aesthetics Use*.

Variable (# indicates reference)	***Support*** – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. No objectionable odor, color, taste or turbidity, or nuisance aquatic life	***Partial Support*** - Objectionable conditions neither frequent nor prolonged	***Non-Support*** – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation

* For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

References

1. Coles, J.C. 1998.*Organochlorine Compounds in Fish Tissue from the Connecticut, Housatonic and Thames River Basins Study Unit, 1992-94.* National Water-Quality Assessment Program. U.S. Department of the Interior, U.S. Geological Survey. Marlborough, MA.
2. Environment Canada. 04 November 1999. Canadian Environmental Quality Guidelines. [Online]. Environment Canada. http://www.ec.gc.ca/ceqg-rcqe/tistbl_e.doc [28 September 1998].
3. MA DEP. 1996. (Revision of 1995 report). *Massachusetts surface water quality standards.* Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA (Revision of 314 CMR 4.00, effective June 23, 1996).
4. MA DEP. 1999. Open File. *Department of Watershed Management 305(b) Assessment* Guidance. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA
5. Persaud, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the protection and management of aquatic sediment quality in Ontario.* Water Resources Branch, Ontario Ministry of the Environment. Queen's Printer for Ontario. Canada.
6. USEPA. 1997. Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement. Assessment and Watershed Protection Division (4503F), Office of Wetlands, Oceans and Watersheds, Office of Water, U.S. Environmental Protection Agency. Washington, DC.
7. USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.
8. MA DPH. 1999. *Freshwater Fish Consumption Advisory List.* The Commonwealth of Massachusetts, Bureau of Environmental Health Assessment. Boston, MA.
9. Kimball, W.A., 1996. Memorandum to 305(b) Committee. *Re: Small data sets/ wet weather data.* Massachusetts Department of Environmental Protection, Office of Watershed Management. Grafton, MA.
10. MA DPH. 1969. *Article 7 Regulation 10.2B of the State Sanitary Code.* Commonwealth of Massachusetts. Department of Public Health. Boston, MA.
11. Churchill, N. 1999. Personal Communication. *Shellfish Project Classification Area Information as of 1 January 1999.* Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries. Pocasset, MA.
12. USEPA. 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia.* U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology. Washington, D.C. an Office of Research and Development, Duluth, MN.

BOSTON HARBOR WATERSHED DESCRIPTION

The Boston Harbor Watershed (Figure 7) is set in and around historic Boston Harbor, and encompasses the Mystic River Subwatershed to the North, and the Neponset and Weymouth and Weir River subwatersheds to the south, as well as the Harbor coastline and all the Harbor Islands. Although the Boston Harbor Watershed is comparatively small in area, it is unique because it sustains over one-sixth of the state's population (approximately 1,070,578 people), more than any other watershed in Massachusetts. The Boston Harbor Watershed encompasses approximately 293 square miles of land area, and includes all or part of 45 municipalities, including most of downtown Boston. The Boston Harbor Watershed is approximately 34% urban, 27% forested, and 3% wetland/salt marsh (EOEA 2000).

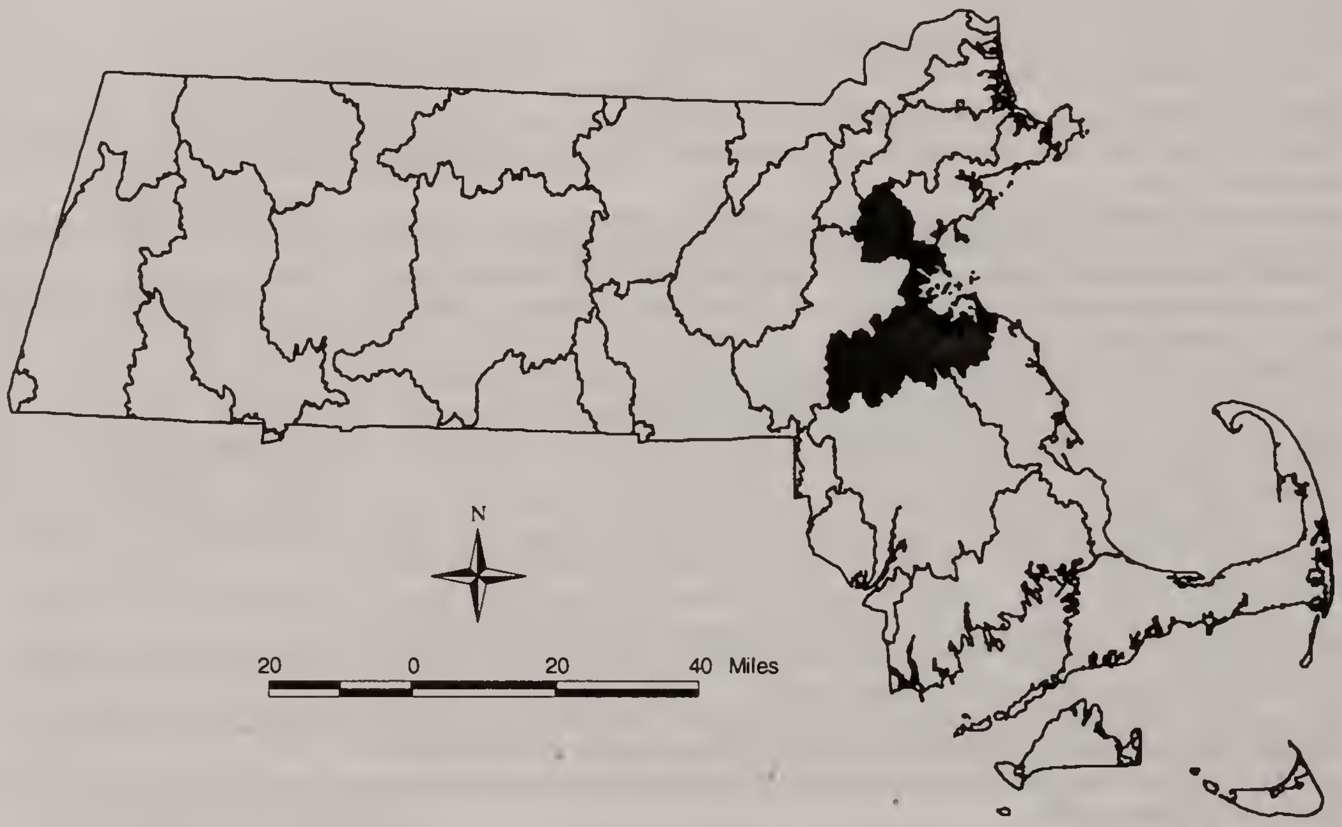


Figure 7. Location of the Boston Harbor Watershed.

MYSTIC RIVER SUBWATERSHED DESCRIPTION

The Mystic River Subwatershed (Figure 8) is bordered by the North Coastal Drainage Area to the Northeast, the Ipswich River Basin to the North, the Shawsheen River Basin to the Northwest, the Charles River Basin to the Southwest and by the Boston Harbor (Proper) Watershed to the Southeast. Nineteen communities (Arlington, Belmont, Boston, Burlington, Cambridge, Chelsea, Everett, Lexington, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Wilmington, Winthrop, and Woburn) lie within or partially within this subwatershed.

The headwaters of the Mystic River include the Aberjona River and Hall's Brook. The 17-mile Mystic River drains approximately 69 square miles and flows through the highly urbanized northern section of the Greater Boston area. Much of the basin is highly developed with considerable industrial and commercial activity. The outlet of Lower Mystic Lake is recognized as the beginning of the Mystic River. Horn Pond Brook in Woburn, Mill Brook in Arlington, and Alewife Brook in Cambridge contribute to the flows in the middle Mystic River. The river flows in a southeasterly direction, and is joined by the Malden River. In 1966, the Amelia Earhart Dam was built on the Mystic River just downstream from its confluence with the Malden River. After the Mystic River flows past the Charlestown piers, and under the Tobin Memorial Bridge, it is joined by the Chelsea River and then enters Boston Inner Harbor. Chelsea River is tidal and flows from Mill Creek, through Revere, Chelsea and East Boston, finally emptying into the Inner Harbor.

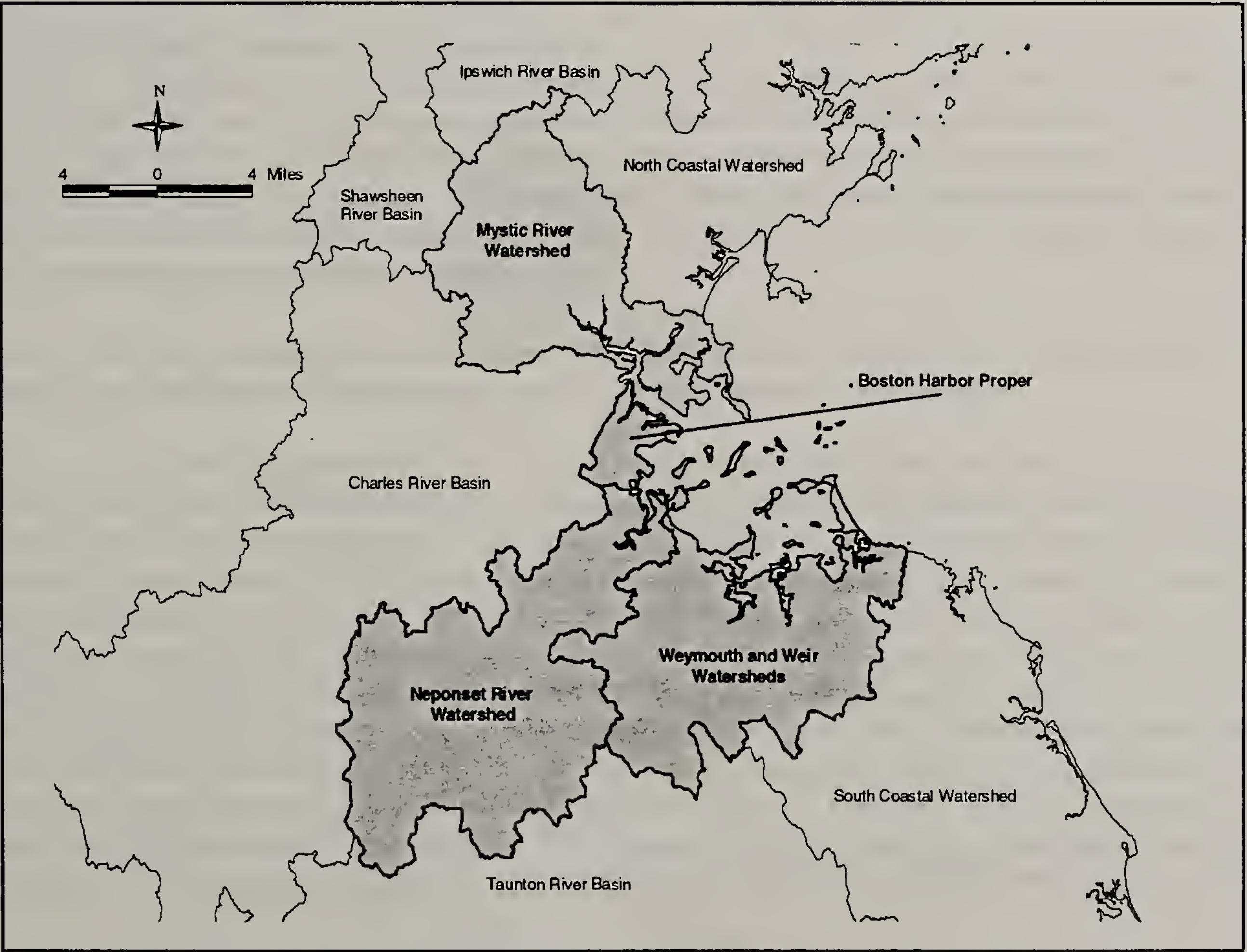


Figure 8. Location of the Mystic River Subwatershed

Recent dredging projects in the Mystic River Subwatershed include the Mystic River (to a depth of 40 feet) and the Moran Terminal, which is used exclusively for shipping automobiles (located just upstream of the Tobin Bridge, on the Mystic River, to 40 feet). Chelsea Creek is the designated port area for the off-loading of the vast majority of petroleum products (including liquefied natural gas) entering Boston Harbor. Eastern Minerals Salt Company, which provides road salt to most of the towns in Massachusetts, also has a facility located on Chelsea Creek. Chelsea Creek is a designated port area and as such recreational boating is not allowed. Recently, industries have left the Chelsea Creek area, providing open space to the adjacent communities. This has spurred grass roots organizations to call for the port area designation to be removed from this waterbody.

Currently there is one Area of Critical Environmental Concern (ACEC) partially located within the Mystic River Subwatershed, the Rumney Marshes. Rumney Marshes was officially designated as an ACEC on 22 August 1988 and lies within the towns/cities of Boston, Lynn, Revere, Saugus, and Winthrop. At least five species listed by Massachusetts as endangered, threatened, or of special concern have been recorded here. The US Fish and Wildlife Service characterized this area as “one of the most biologically significant estuaries in Massachusetts north of Boston” (DEM August 2000).

NEPONSET RIVER SUBWATERSHED DESCRIPTION

The Neponset River Subwatershed (Figure 9) is located in the western portion of the Boston Harbor Watershed. Fourteen communities (Boston, Canton, Dedham, Dover, Foxborough, Medfield, Milton, Norwood, Quincy, Randolph, Sharon, Stoughton, Walpole, and Westwood) lie within or partially within the area drained by the Neponset River.

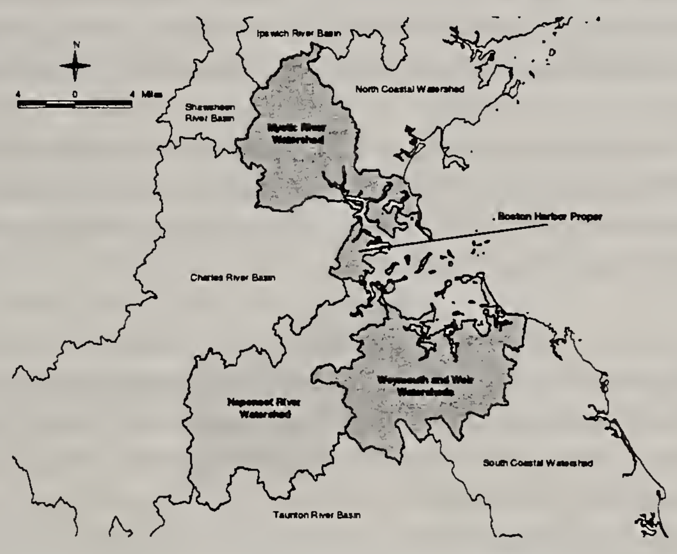


Figure 9. Location of the Neponset River Subwatershed

The Neponset River Basin borders the city of Boston on the north and Quincy on the south; it drains a watershed of 123 square miles. The headwaters of the Neponset River originate in Foxborough at Neponset Reservoir, a manmade impoundment of 272 acres. The river generally flows in a northeasterly direction and after traveling approximately 30 miles empties into Dorchester Bay. The river is impounded by 12 dams and passes through several mills and private reservoirs. The East Branch is the major tributary to the mainstem Neponset River. Mother Brook, a man-made diversion, conveys Charles River flow to the Neponset River. Most of the Neponset River is a fresh water stream. However, after the impoundment in Milton, by the Walter Baker Dam, the river becomes tidal. The first dam on the Neponset River was constructed by Israel Stoughton in 1633 (NepRWA undated). The river has a strong industrial history predating the Industrial Revolution and was used to power textile, paper, and lumber mills, in manufacturing processes, and for the disposal of by-products and wastes (NepRWA 2001b).

There are 64 lakes and ponds in the Neponset River Subwatershed, which have a total area of 1,935 acres. The largest lake in the basin is Massapoag Lake in Sharon, which is 353 acres.

Currently, there are two designated ACEC's in the Neponset River Subwatershed, the Neponset River Estuary ACEC and the Fowl Meadow and Ponkapoag Bog ACEC. The Neponset River Estuary ACEC in Boston, Milton, and Quincy was officially designated as an ACEC on 27 March 1995. The ACEC encompasses approximately 1,300 acres. Approximately 80% of the ACEC consists of floodplains and two-thirds of the ACEC is composed of open water, salt marsh, and other wetland resource areas. The Neponset River Estuary ACEC supports valuable anadromous fishery habitat, soft-shell clam beds, commercially and recreationally important finfish species, and numerous bird species. The Fowl Meadow and Ponkapoag Bog ACEC was officially designated on 20 August 1992 and encompasses approximately 8,350 acres in Boston, Canton, Dedham, Milton, Norwood, Randolph, Sharon, and Westwood. Several municipal public wells within this ACEC provide water to Canton, Dedham, and Westwood. At least 13 state-listed rare species occur in the ACEC. The National Park Service has designated the northern Fowl Meadow area and Ponkapoag Bog as a National Environmental Study Area (MA DEM August 2000).

WEYMOUTH AND WEIR SUBWATERSHED DESCRIPTION

The Weymouth and Weir Subwatershed (Figure 10) is located in the southeast region of the Boston Harbor Watershed. The following sixteen communities lie within or partially within the areas drained by the Weymouth and Weir Rivers: Abington, Avon, Braintree, Brockton, Canton, Cohasset, Hingham, Holbrook, Hull, Milton, Norwell, Quincy, Randolph, Rockland, Stoughton, and Weymouth.

This Subwatershed is comprised of five systems; Furnace Brook, Town River, Weymouth Fore River, Weymouth Back River and Weir River. Furnace Brook flows northeast draining to Quincy Bay, and the remaining four rivers flow generally northeast to Hingham Bay. The Weymouth Fore and Weymouth Back Rivers are both tidal.

Furnace Brook is a 2.7-mile brook located in Quincy. The brook flows northeasterly to Blacks Creek, and then into Quincy Bay. The Town River System originates as Town Brook in the Blue Hills. The brook flows 3.2 miles from the Old Quincy Reservoir through downtown Quincy to the Town River. The Town River then flows into Town River Bay, which joins with the Weymouth Fore River at Germantown Point, before flowing into Hingham Bay.

The Weymouth Fore River System originates at Lake Holbrook in Holbrook, and flows northerly as the Cochato River for 4.0 miles. The Farm River, a 2.7-mile river beginning in Milton, joins the Cochato River in Braintree to form the Monatiquot River. The Monatiquot River, considered the mainstem, flows north then east for a total of 4.3 miles to the Weymouth town line where the river becomes a tidal estuary and is called the Weymouth Fore River. Several of the tributaries that contribute to the rivers flow are: Lee Brook, Glovers Brook, Tumbling Brook, and Cranberry Brook. The Cranberry Brook Watershed ACEC in Braintree and Holbrook was officially designated as an ACEC on 28 July 1983. The ACEC encompasses approximately 1050 acres and includes wooded swamps, a marsh, pond, stream and two quaking sphagnum bogs. The bogs contain two carnivorous indigenous plant species, the sundew and pitcher plant. The watershed contributes high-quality water to Richardi Reservoir, which supplies water for Braintree, Holbrook, and Randolph (MA DEM August 2000).

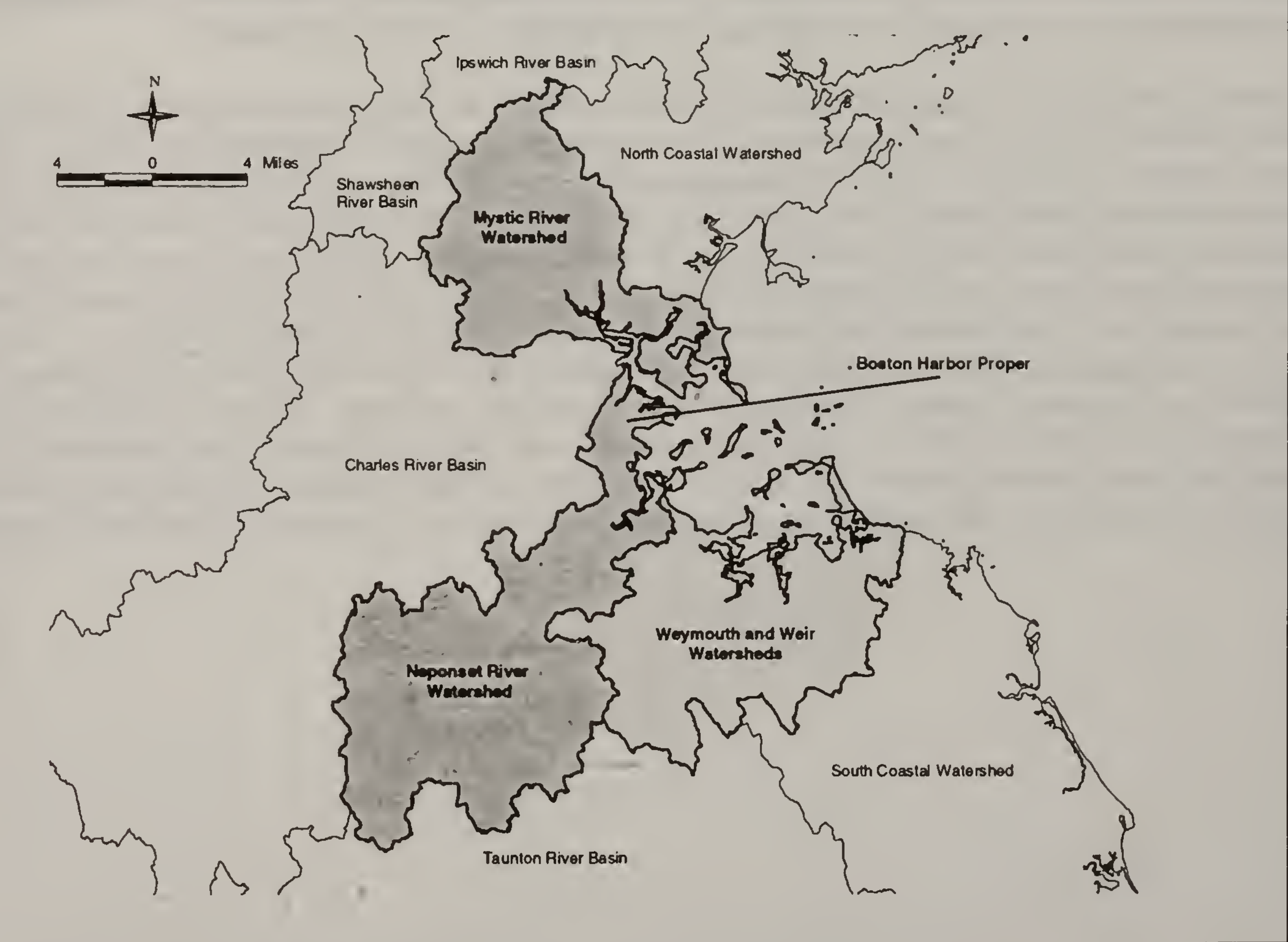


Figure 10. Location of the Weymouth and Weir Subwatershed.

The Weymouth Back River System is to the east of the Weymouth Fore River, and the hydrology parallels that of the Weymouth Fore River. The Old Swamp River originates in Rockland and flows northerly for 4.4 miles to the southern shore of Whitmans Pond, Weymouth. The Mill River originates at the outlet of Weymouth Great Pond and flows 3.5 miles to the western shores of Whitman Pond. The Weymouth Back River originates at the outlet of Whitmans Pond. It flows northerly under a network of streets and intersections for 0.8 miles to the Weymouth Back River estuary, forming the town line between Weymouth and Hingham. The Weymouth Back River ACEC in Hingham and Weymouth was officially designated as an ACEC on 10 September 1992. Fresh River (Hingham), Weymouth Back River (Weymouth), Brewer Pond (Hingham), Bouve Pond (Hingham), Whitman's Pond (Weymouth), Bear Swamp (Hingham) and Herring Brook (Weymouth) are all included within the boundaries of this 950-acre ACEC. Approximately 180 acres are tidal waters flushing into Hingham Bay and serve as shellfish areas and nursery grounds for finfish. Alewives and smelt return to this ACEC to spawn (MA DEM August 2000).

The final subwatershed is the Weir River System, the easternmost of the five rivers. The Weir River is formed at the confluence of Crooked Meadow River and Fulling Mill Brook, and flows 2.8 miles to its tidal portion in Hingham. This system is comprised of the Plymouth, Crooked Meadow and Weir Rivers. Tributaries to these rivers include Accord, Norroway, and Tumbling brooks and the Eel River. The Weir River ACEC in Cohasset, Hingham, and Hull was designated as an ACEC on 11 December 1986 and includes approximately 950 acres. This area supports over 100 species of migratory and resident bird species, as well as an abundance of shellfish and finfish. Abutting the ACEC are two recreationally important areas, a designated barrier beach (Nantasket Beach) and World's End Park (MA DEM August 2000).

BOSTON HARBOR (PROPER) DESCRIPTION

The Boston Harbor (Proper) is located on the eastern coast of Massachusetts (Figure 11). It is bordered by the Charles River Basin to the north and west, the Taunton River Basin to the south and by the South Shore Coastal Drainage Area to the southeast. Boston Harbor Proper (the marine portion of this watershed) includes shoreline areas of Boston, Quincy, Hull and Chelsea. It extends south from the Chelsea River, east from the Charles River Dam, north from Hingham Bay and east from the confluence of the Neponset River with Dorchester Bay to a line connecting the Boston Lighthouse to Deer Island in Boston and Point Allerton in Hull. The harbor includes Fort Point Channel, Dorchester Bay with an area of 809 ha (2,000 acres), Quincy Bay 4,452 ha (11,000 acres), Hingham Bay, 1,821 ha (4,500 acres) and Hull Bay, 567 ha (1,400 acres).

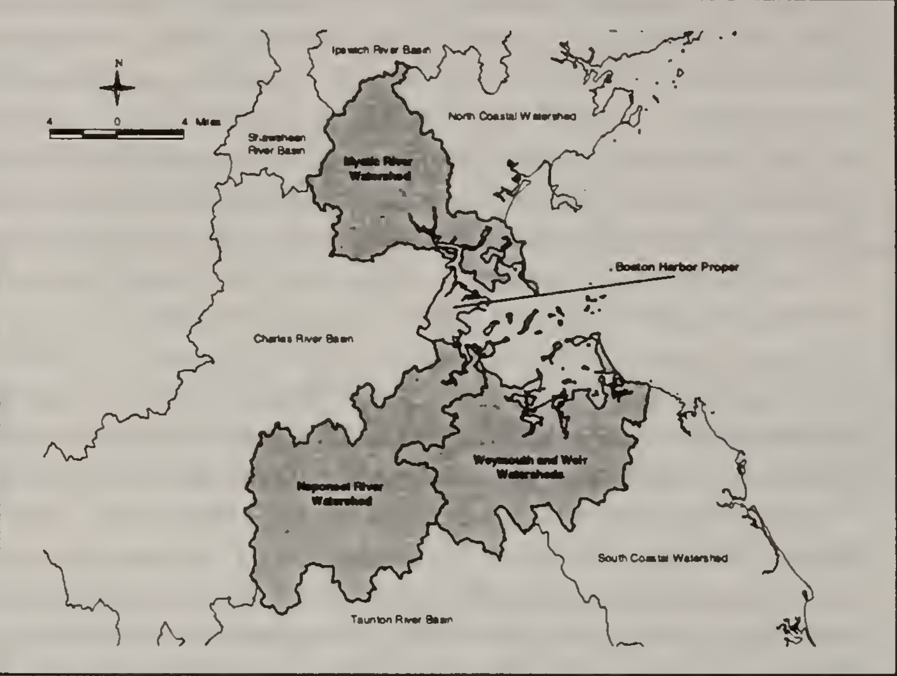


Figure 11. Location of the Boston Harbor (Proper)

The Harbor Islands State Park is comprised of 17 of the 34 Boston Harbor Islands, which range in size from less than one acre to greater than 200 acres. Together, the islands total approximately 1,600 acres. The Boston Harbor Islands Park was designated a national recreation area in 1996. Many of the islands are drumlins or glacier formed, asymmetrical, elongate masses forming sloped hills or bedrock outcroppings (Boston Harbor Islands 2002). Historical and recreational information for the Boston Harbor Islands can be found at http://www.bostonislands.org/.

The City of Boston and the Massachusetts Department of Environmental Management (MA DEM) jointly own Spectacle Island. Its original shape, two drumlins joined by a narrow sidebar, resembled a pair of spectacles and gave the island its name. Native Americans used the island to fish, harvest clams, and gather other food. After 1660, colonists used the island for pastureland and timber. Between 1717 and 1737, the island housed a quarantine hospital for patients with infectious diseases. In 1847, two resort hotels with casinos were built. Later uses included horse rendering and reclaiming grease from garbage. The City dumped garbage on the island until 1959. Leachate from the landfill contributed to harbor pollution. In 1978, DEM acquired a privately owned portion of Spectacle Island. Throughout the 1980s, extensive planning and permitting resulted in an agreement to deposit 3.6 million cubic yards of filling and excavated materials from the Central Artery/Tunnel (CA/T) project on the island. Spectacle Island will be the water-transportation hub and orientation center for information about the Boston Harbor Island National Park Area. Spectacle Island Park, which will include a visitor's center, two sandy beaches, a marina, and spectacular 360-degree views of Boston Harbor, will be managed by a partnership including the City, MA DEM, New England Aquarium, Modern Continental, and the University of Massachusetts Urban Harbors Institute (City of Boston 2000b).

Boston Harbor receives the drainage, including waste discharges, from four major coastal streams – the Mystic, Charles, Neponset and the Weymouth Fore Rivers. It also receives discharges from the entire waterfront and minor tributary areas extending from Winthrop to Hull. The total flow from tributary streams averages 350 cfs during the summer. This flow is very low compared to the daily inflow of salt water during tidal flushing, which averages 320,000 cfs for a six-hour period.

Boston Harbor is a vital seaport, shipping and receiving more than a million metric tons of containerized cargo, more than 32 million metric tons of bulk cargo (12 million in petroleum products), and more than 120,000 cruise passengers per year. As the trend in constructing larger ships continues, dredging of

Boston Harbor is performed to maintain access to the Inner Harbor by these deep draft vessels. Recent projects have dredged the Reserved Channel.

Logan Airport is a dominant feature of Boston Harbor. In 1923, the Boston Airport was opened on 189 acres on Jeffries Point in East Boston. In 1928, the ownership of the airport passed from the US Army to the Massachusetts Legislature. The Legislature renamed the airport Lt. General Edward Lawrence Logan Airport in 1956. The airport's history has been one of almost constant expansion. More than 2,200 acres of Boston Harbor has been filled in (including Bird Island Flats) to expand the airport to its present size of 2,400 acres. Today. Logan is the nation's 17th busiest airport. In 2000, Logan documented 478,873 flight operations, 27,412,926 airport passengers, and 853,347,154 pounds of freight and mail. Logan Modernization, a $1 billion program, includes first, the Logan Landside program, which involves structural changes to the airport and the second is the Logan Airside program, which involves various alternatives for reducing current and projected levels of aircraft delay and enhancing operational safety at Logan. The Landside portion of the program includes the expansion and improvement of Terminal E (to be completed in 2003), construction and opening of a new hotel in 1999, addition of a new garage, new airport roadways (to be completed in 2003), and a new jet fuel distribution and storage system that was completed in 1999. The Airside portion includes the construction of a new uni-direction over-the-water runway, centerfield taxiway, and reduced minimum approaches (MassPort 2002).

The "Big Dig", officially known as the Central Artery Tunnel project, is designed to reconstruct portions of I-93 (the Central Artery) and I-90 (the Ted Williams Tunnel). The entire project will create approximately 7.5 miles of road and tunnel, at an estimated cost of more than 14 billion dollars. The CA/T began in 1981 with a MA DPW Feasibility Assessment. Actual construction began in September of 1991, with the groundbreaking for the Ted Williams Tunnel, and the entire project is scheduled to be completed in 2004. The Ted Williams Tunnel, running from South Boston to Logan Airport, was completed in December of 1995. The Leverett Circle Connector Bridge, carrying traffic over the Charles River, was completed in October of 1999. Four other "milestones" are yet to be achieved. They are:

- The I-90 Extension, which will extend the MassPike from South Boston to the Ted Williams Tunnel. This extension is to be completed in September of 2002.
- The Northbound Central Artery, which will allow underground passage of northbound vehicles from the Leonard P. Zakim Bunker Hill Bridge. This artery is to be completed by November 2002.
- The Southbound Central Artery, which will allow underground passage of northbound vehicles from the Leonard P. Zakim Bunker Hill Bridge. This artery is to be completed by November 2003.
- The demolition of the Elevated Central Artery, which will complete the project. This demolition will allow for the construction of 27-acres of open space. The entire project is scheduled for completion in December 2004.

More than one million cubic yards of clays, dredged from the construction of the Ted Williams Tunnel, have been dumped into the Stellwagen Basin in the outer harbor. As part of the mitigation response to this action, and others, the City of Boston was required to remediate 18-acres of Rumney Marsh in Revere. Approximately 300,000 cubic yards of sand (dumped in the marsh in the 1960s) was removed and used on the CA/T and other projects. Tidal waters once again flow in and out of the marsh, and estuarine vegetation has begun to return.

Also, excavated materials from the tunnel, and the central artery have been dumped onto Spectacle Island. The footprint of the island has increased, and filled in approximately 1.6 acres of blue mussel (*Mytilus edulis*) beds. The US Army Corps of Engineers (ACOE) permitted the deposition of fill and required the City of Boston to construct a two-acre artificial reef to mitigate the loss of existing mussel beds. This reef is located in the Sculpin Ledge Channel (between Spectacle and Long Islands). The reef consists of a series of concrete tiered panels, and cobble/boulder patch reefs (Big Dig 2000).

CLASSIFICATION

The designation of Outstanding Resource Waters (ORW) is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values (MA DEP 1995). ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools and all designated Class A Public Water Supplies, and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

Unlisted waters in Boston Harbor not otherwise designated in the SWQS, are designated *Class B, High Quality Waters* for inland waters and Class SB, High Quality Waters for coastal and marine waters. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

Consistent with the National Goal Uses of "fishable and swimmable waters", the classification of waters in the Boston Harbor Watershed according to the 1998 SWQS, include the following (MA DEP 1996):

"Class A – These waters are designated as a source of public water supply. To the extent compatible with its use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW') under 314 CMR 4.04(3)" (Rojko *et al.* 1995).

Class A Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
North Reservoir, Middle Reservoir, and South Reservoir, source to outlet in Winchester, Stoneham, Medford, and those tributaries thereto Fresh Pond, source to outlet in Cambridge and those tributaries thereto	None	Great Pond, source to outlet in Braintree and those tributaries thereto Upper Reservoir, source to outlet in Braintree and those tributaries thereto Whitmans Pond, source to outlet in Weymouth and those tributaries thereto Richardi Reservoir, source to outlet in Braintree and those tributaries thereto Weymouth Great Pond, source to outlet in Weymouth and those tributaries thereto Accord Pond, source to outlet in Hingham and those tributaries thereto Accord Brook, outlet of Accord Pond to water supply intake and those tributaries thereto	None

"Class B – These waters are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value."

Class B Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Aberjona River, source to outlet Mishawum Lake (CSO)* Aberjona River, outlet Mishawum Lake to inlet Mystic Lake (CSO)* Upper Mystic Lake (CSO)* Lower Mystic Lake (CSO)* Mystic River, outlet Lower Mystic Lake to Amelia Earhart Dam (CSO)* Malden River, entire length Alewife Brook, entire length* Horn Pond, Woburn	Neponset Reservoir, Upstream of dam at outlet of Crackrock Pond (High Quality Water) Neponset River, source to Mother Brook Neponset River, Mother Brook to Milton Lower Falls Dam, Milton/Boston (CSO)*	Weymouth Fore River, Weymouth Back River (ORW), Fresh River, (ORW) Weir River, (ORW), Cranberry Brook, (ORW) Cranberry Pond, source to outlet in Braintree (ORW) Bouve Pond and Brewer Pond in Hingham (ORW) Straits Pond in Hull and Cohasset (ORW)	None

* In the 2002 update of the SWQS, the CSO designation for the Aberjona River, the Mystic Lakes, and the Neponset River will be removed. Additionally, a CSO Variance designation will be added to Alewife Brook and the Mystic River (Brander 2002).

"Class SA – These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value."

Class SA Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Belle Isle Inlet, and tributaries thereto (ORW)	None	Weymouth Back River, (ORW) Weir River	Quincy Bay, in Quincy from Bromfield Street near Wallaston Yacht Club northerly to buoy "C 1" southeasterly to the "Willows", sometimes known as Lord's Point on the northerly shore of Hough Neck in Quincy (CSO)* Hingham Harbor, in Hingham inside a line from Crows Point to Worlds End Promontory

* In the 2002 update of the SWQS, the CSO designation for Quincy Bay will be removed (Brander 2002).

"Class SB – These waters are designated as habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value."

Class SB Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Mystic River, Amelia Earhart Dam to confluence with Chelsea River (CSO)*	Neponset River, Tidal portion (CSO)	Weymouth Fore River	Inside a line from the southerly tip of Deer Island to Boston Lighthouse to Point Allerton in Hull except as denoted below Boston Inner Harbor, westerly inside a line from the southern tip of Governors Island to Fort Independence including the Charles, Mystic, Island End, and Chelsea (Creek) Rivers and Reserved, Fort Point and Little Mystic Channels (CSO)* Dorchester Bay, (CSO)* Remainder of Quincy Bay, (CSO)* Hull Bay

* In the 2002 update of the SWQS, the CSO designation for Dorchester and Quincy bays will be removed. Additionally, Mystic River and Boston Inner Harbor will be designated SB/CSO (Brander 2002).

CSO-impacted Segments

A Combined Sewer Overflow (CSO) is any intermittent overflow, bypass, or other discharge from a municipal combined sewer/storm water system which results from a wet weather flow in excess of dry weather carrying capacity of the system. CSO designated segments are identified as being impacted by the discharge of combined sewer overflows. Overflows may be allowed by the permitting authority without a variance or partial use designation provided that:

a. an approved facilities plan under 310 CMR 41.25 provides justification for the overflows;
b. the Division finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
d. public notice is provided through procedures for permit issuance or facility planning under M.G.L. c. 21 §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Division will publish a notice in the *Environmental Monitor.*

Other combined sewer overflows may be eligible for a variance granted through permit issuance procedures. When a variance is not appropriate, partial use may be designated for a segment after public notice and opportunity for a public hearing in accordance with M.G.L. c. 30A.

A CSO-impacted segment can be reclassified to B/SB (CSO), B (partial), C, or a CSO Variance can be issued only where a CSO facilities plan demonstrates that elimination of CSOs is not feasible. In those instances, the highest feasible level of CSO control must be implemented and the receiving water may be reclassified accordingly. The technical and cost information included in the CSO Facilities Plan forms the basis of these determinations and must support a Use Attainability Analysis where a downgrade to B (CSO), B (partial), or C is being considered. [NOTE: A B (CSO) designation only allows for "exceedances" of the B standard for CSO discharges and does not allow for other discharges to exceed the B standard.] A CSO Variance may be issued to allow continued discharge of CSOs while additional data and information are developed to make a final determination on the appropriate water quality standard and level of CSO control (Brander 2001a). In the Boston Harbor Watershed, the Massachusetts Water Resource Authority (MWRA), Boston Water and Sewer Commission, and the towns of Cambridge, Sommerville, and Chelsea are responsible for CSOs.

For those CSOs where elimination was determined to be infeasible, MWRA included information in its 1997 Final CSO Facilities Plan to support a Use Attainability Analysis (UAA) pursuant to 40 CFR Section 131.10 (g). A UAA is a scientific assessment of the technical and economic factors affecting attainment of a use which is conducted by the state and which supports removal of a National Goal Use based on criteria such as costs and impacts associated with attaining that use. The state submitted its final administrative determinations, including a UAA, to EPA for approval on 31 December 1997. On 27 February 1998, EPA approved the state's changes to water quality standards which included removal of CSO-impacted designations for the Neponset River, North Dorchester Bay, South Dorchester Bay, and Constitution Beach; an SB_{CSO} designation for Boston Inner Harbor; a B_{CSO} designation for the Muddy River; and a tentative determination for the issuance of a CSO Variance for the Lower Charles River Basin, Alewife Brook, and the Upper Mystic River (Brander 2001b).

For receiving waters designated SB_{CSO} (i.e., Boston Inner Harbor), the water quality standard is achieved when the discharger completes construction of the CSO abatement facilities in accordance with the approved Facilities Plan, and achieves the performance goals and water quality results defined in the Facilities Plan. This level of control, therefore, becomes the level of control necessary to attain the standard and becomes the basis for the permittee's requirements and discharge limits for each outfall to remain active in the receiving water.

For receiving waters designated SB (e.g., Dorchester Bay), no CSO discharges are authorized under the Massachusetts Water Quality Standards. Since the Facilities Plan demonstrated that the elimination of CSO discharges could feasibly be achieved through sewer separation, the water quality classification for Dorchester Bay is SB. However, at this time, there remain two CSO treatment facilities which discharge to Dorchester Bay, the Fox Point and Commercial Point CSO treatment facilities. These facilities have recently been upgraded by adding dechlorination and will remain active as interim CSO control facilities until the CSO separation projects recommended in the approved CSO facilities plan and mandated by the Federal Court are completed

On October 1, 1998, a two-year CSO Variance was issued to MWRA, Boston Water and Sewer Commission, and the Town of Cambridge and on 5 March 1999, a three-year CSO Variance was issued to MWRA and the Cities of Cambridge and Somerville, which authorize continued CSO discharges to the Charles River and the Alewife/Upper Mystic watershed. The purpose of the CSO Variance is to (1) require MWRA and the member CSO communities to expeditiously implement those CSO controls determined to be feasible and cost-effective in the 1997 approved CSO Facilities Plan, and (2) to allot additional time for the development of additional water quality data and technical information to support a final CSO abatement plan and associated water quality standard. The condition of the CSO Variance issued in Upper Mystic/Alewife Basin require the MWRA and member CSO communities to move forward with the recommended plan, further define storm water and CSO pollutant loads, and re-evaluate CSO controls. EPA and the MA DEP will review the additional information developed during the period of the CSO Variance, and after opportunity for public comment, determine whether a higher level of CSO control is feasible (Brander 2001b).

The Alewife/Upper Mystic Variance remains effective for three years to 5 March 2002 and may be extended at the discretion of the MA DEP with approval of EPA. MA DEP presently intends to extend the Alewife/Upper Mystic Variance for an additional 18 months, to September 5, 2003, to allow MWRA adequate time to properly prepare a final CSO assessment, and for the requisite public environmental review of the documents (Brander 2001b). It is also important to note that the Variance now requires MWRA to move forward with a $74 million CSO abatement program in the Alewife/Upper Mystic Basin. This program has been identified in the April 30, 2001 MWRA Notice of Project Change in lieu of the 1997 $12 million plan, since the combined sewer system and resulting CSO impacts were subsequently found to be far more extensive than previously known. A final determination on the ultimate level of CSO abatement required and the associated water quality standard will be made at the end of the Variance period.

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Clean Water Act required that all communities in the United States upgrade their sewage treatment facilities to secondary treatment by 1977. The 301(h) provision in the Clean Water Act allowed municipalities to continue to discharge primary treated effluent to offshore receiving waters if the municipality could document that their discharge would do no environmental harm. In the late 1800s through the turn of the century, public health concerns led the Metropolitan District Commission (MDC) to construct sewer outfalls off Deer and Nut Islands. The Deer and Nut Island primary sewage treatment plants were completed in 1952 and 1969, respectively, eliminating most of the raw sewage discharges into the harbor. (Primary treatment involves the removal of total suspended solids, pathogens and toxic contaminants through settling lagoons or tanks.) In 1978, the MDC began funding scientific research to support its waiver application (under section 310(h) of the Clean Water Act) to build a large outfall at 35 meters depth in Massachusetts Bay. The initial waiver application was denied in 1983 and the MDC reapplied. While this waiver was under review, the Massachusetts Water Resource Authority (MWRA) was created. In March 1985, the EPA Regional Administrator denied the waiver application. In August 1985, the MWRA and EPA agreed that MWRA should build the Mass Bay outfall and that treatment of the effluent should be upgraded to full secondary treatment, which utilizes biological filtration to remove dissolved organic matter (Gallagher and Keay 1998). [Note: These facilities have now been constructed. MWRA now provides secondary treatment for wastewater flows and the treated effluent is discharged through a nine-mile outfall tunnel into Massachusetts Bay. Additional information on the Deer Island Treatment Plant is available online at the MWRA's website www.mwra.state.ma.us.]

Sanitary sewer overflows (SSO) are recognized as important topics across the entire Boston Harbor watershed since raw sewage discharges cause water quality violations in the receiving waters, including the Harbor. Excessive infiltration and inflow (I/I) into sanitary sewers are recognized as two of the leading problems contributing to the surcharging of sewers and overflows. In addition, excessive amounts of groundwater and storm water, as I/I, entering sewer systems designed specifically for sanitary wastewater contributes to depletion of clean water in the basin that could otherwise be utilized to replenish local surface water and groundwater public water supplies. Retention of this groundwater and storm water in the watershed could also enhance minimum stream flows necessary to support aquatic life and meet water quality standards (Chretien 2002).

The majority of the Boston Harbor watershed is developed and sewage is handled by municipal collection systems that predominantly discharge to the MWRA regional collection system. Because of the interconnection of the municipal and MWRA system, DEP has acknowledged that only a regional and cooperative effort concerning better collection system operation and maintenance and I/I reduction will effect results in the Boston Harbor Watershed (Chretien 2002).

As part of the Administrative Consent Order (ACO) with MWRA for the construction of the Braintree Weymouth Relief Facilities, MWRA agreed to establish an I/I Task Force with its member communities and other interested stakeholders including DEP. Task Force recommendations resulted from two years of meetings to help direct the activities of MWRA, municipalities, DEP, and EPA to cooperatively reduce the amount of extraneous clean water entering the regional sewer system. Implementation of these recommendations will require DEP involvement in ongoing workgroups and future workshops, such as the one on Private Inflow Redirection held in November 2001 (Chretien 2002).

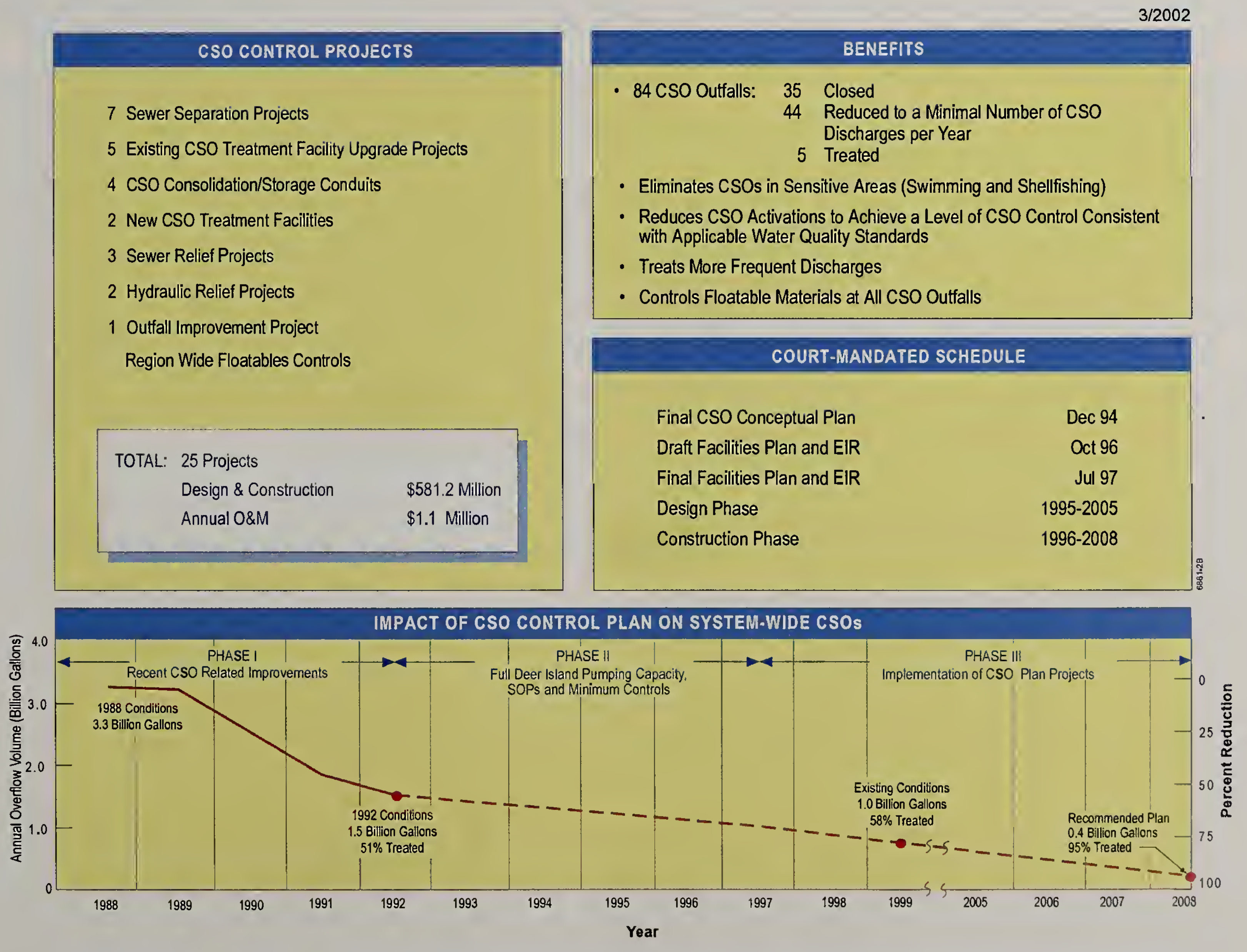
DEP will be working with MWRA during 2002 to develop an Interagency Agreement to delineate responsibilities and schedules of activities to further improve the performance of the regional collection system. DEP, with EPA, has further encouraged regional collection system cooperation by including expanded provisions in the MWRA National Pollutant Discharge Elimination System (NPDES) Permit relating to collection system Operations & Maintenance (Chretien 2002).

MWRA CSO Plan

In 1987, through a Stipulation entered in the Boston Harbor Case (U.S. v. M.D.C., et al., No. 85-0489 (D. Mass)), MWRA accepted responsibility for developing a control plan to address CSO discharges from all CSOs hydraulically connected to the MWRA sewer system, including outfalls owned by the member communities. Under a Court-ordered schedule, MWRA developed a CSO Conceptual Control Plan in

1994, recommending more than 25 site-specific CSO projects located in Boston, Cambridge, Somerville and Chelsea. The CSO Conceptual Control Plan was later refined; and, on 31 July 1997, the MWRA filed a CSO Final Environmental Impact Report /Final Facilities Plan (FEIR/FFP) to the Massachusetts Environmental Policy Act (MEPA) office and MA DEP. Based on a review of this document and the comments received, a MEPA certificate for the project was issued on 30 October 1997 (Brander 2001b). Figure 12 includes a summary of the approved 1997 MWRA CSO Plan. The $581 million dollar Plan eliminates CSOs to all sensitive use areas and provides a high level of CSO control in all CSO receiving waters. The Plan is in the implementation phase and will proceed through 2008. Figure 13 notes the status of the work and CSO outfalls eliminated to date.

In 1996, design and construction milestones for the 25 projects in the Final CSO Plan were added to the Federal Court Schedule, requiring implementation of the projects from 1996 to 2008. MWRA is directly responsible for implementation of many of the projects and has negotiated agreements with three CSO communities (Boston Water & Sewer Commission, City of Cambridge, City of Somerville) for implementation of certain projects affecting the community systems. The facilities plan evaluated and selected abatement alternatives for each CSO and was conducted in accordance with EPA's National CSO Control Policy and DEP's Guidance for Abatement of Pollution from CSO Discharges (Brander 2001b).



3/2002

CSO CONTROL PROJECTS

7 Sewer Separation Projects
5 Existing CSO Treatment Facility Upgrade Projects
4 CSO Consolidation/Storage Conduits
2 New CSO Treatment Facilities
3 Sewer Relief Projects
2 Hydraulic Relief Projects
1 Outfall Improvement Project
Region Wide Floatables Controls

TOTAL:	25 Projects	
	Design & Construction	$581.2 Million
	Annual O&M	$1.1 Million

BENEFITS

- 84 CSO Outfalls: 35 Closed
  44 Reduced to a Minimal Number of CSO Discharges per Year
  5 Treated
- Eliminates CSOs in Sensitive Areas (Swimming and Shellfishing)
- Reduces CSO Activations to Achieve a Level of CSO Control Consistent with Applicable Water Quality Standards
- Treats More Frequent Discharges
- Controls Floatable Materials at All CSO Outfalls

COURT-MANDATED SCHEDULE

Final CSO Conceptual Plan	Dec 94
Draft Facilities Plan and EIR	Oct 96
Final Facilities Plan and EIR	Jul 97
Design Phase	1995-2005
Construction Phase	1996-2008

6861-28

IMPACT OF CSO CONTROL PLAN ON SYSTEM-WIDE CSOs

Figure 12. Summary of MWRA 1997 CSO Final Environmental Impact Report /Final Facilities Plan (FEIR/FPP). Graphic courtesy of Massachusetts Water Resources Authority.

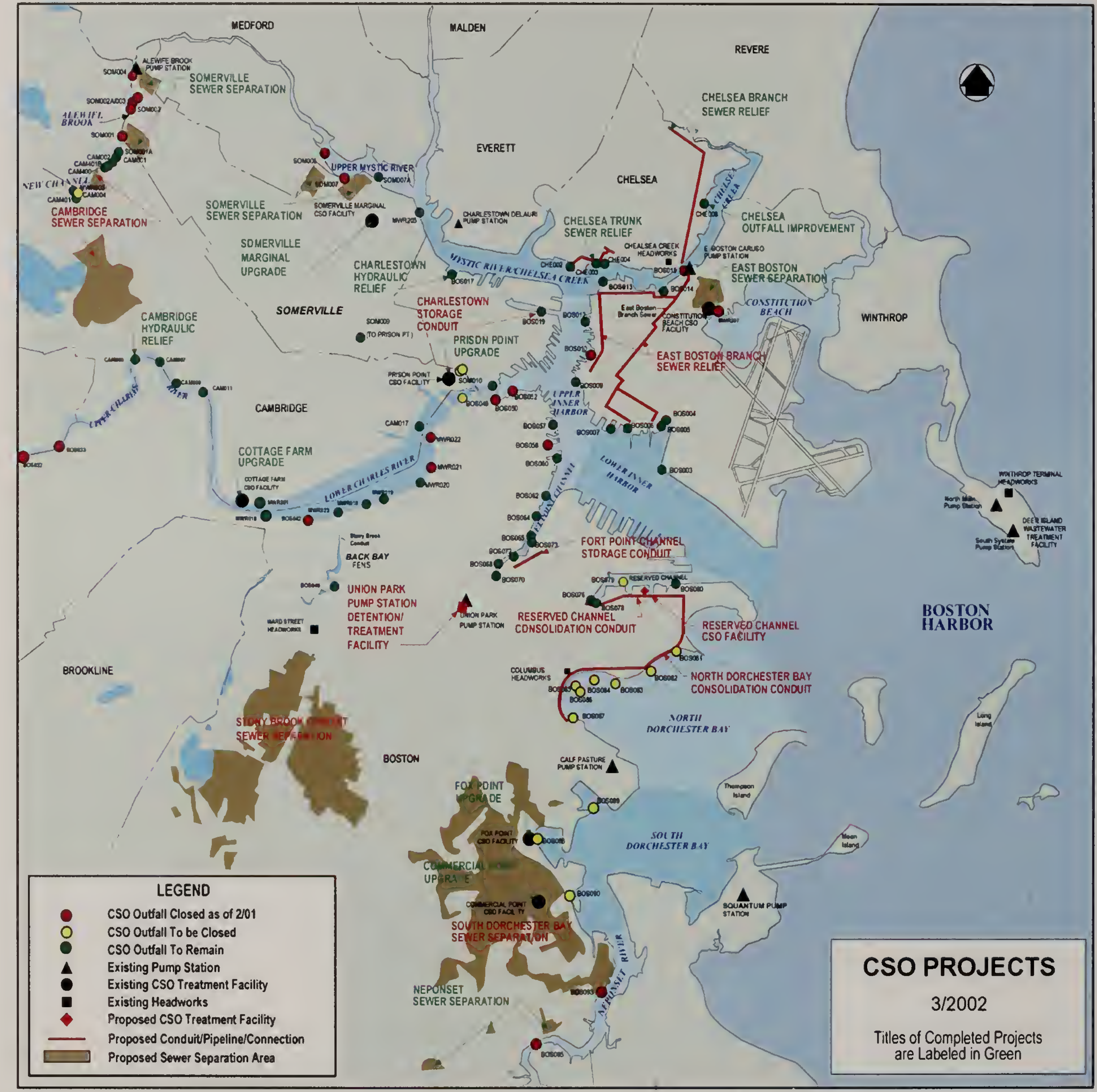

MEDFORD
MALDEN
REVERE
EVERETT
CHELSEA
SOMERVILLE
CAMBRIDGE
BROOKLINE
BOSTON
WINTHROP
BOSTON HARBOR
ALEWIFE BROOK PUMP STATION
SOM004
SOMERVILLE SEWER SEPARATION
SOM002A/003
SOM003
ALEWIFE BROOK
SOM001
SOM001A
CAM002
CAM401B
CAM001
CAM400
NEW CHANNEL
MWR003
CAM401
CAM004
CAMBRIDGE SEWER SEPARATION
SOM006
UPPER MYSTIC RIVER
SOM007
SOM007A
SOMERVILLE SEWER SEPARATION
SOMERVILLE MARGINAL CSO FACILITY
MWR205
CHARLESTOWN DELAURI PUMP STATION
SOMERVILLE MARGINAL UPGRADE
CHARLESTOWN HYDRAULIC RELIEF
BOS017
MYSTIC RIVER/CHELSEA CREEK
CHARLESTOWN STORAGE CONDUIT
BOS019
SOM009
(TO PRISON PT.)
PRISON POINT UPGRADE
PRISON POINT CSO FACILITY
SOM010
BOS049
BOS050
BOS052
CAMBRIDGE HYDRAULIC RELIEF
UPPER CHARLES RIVER
CAM011
CAM017
MWR022
MWR021
MWR020
COTTAGE FARM UPGRADE
COTTAGE FARM CSO FACILITY
MWR201
MWR018
MWR023
MWR019
BOS042
LOWER CHARLES RIVER
BOS033
BOS032
Stony Brook Conduit
BACK BAY FENS
BOS046
UNION PARK PUMP STATION DETENTION/ TREATMENT FACILITY
WARD STREET HEADWORKS
UNION PARK PUMP STATION
STONY BROOK CONDUIT SEWER SEPARATION
CHELSEA BRANCH SEWER RELIEF
CHELSEA CREEK
CHE008
CHELSEA OUTFALL IMPROVEMENT
CHELSEA TRUNK SEWER RELIEF
CHEALSEA CREEK HEADWORKS
E. BOSTON CARUSO PUMP STATION
CHE002
CHE003
CHE004
BOS015
BOS013
BOS014
EAST BOSTON SEWER SEPARATION
CONSTITUTION BEACH
East Boston Branch Sewer
CONSTITUTION BEACH CSO FACILITY
MWR207
BOS012
BOS010
BOS009
EAST BOSTON BRANCH SEWER RELIEF
UPPER INNER HARBOR
BOS004
BOS005
BOS006
BOS007
BOS003
BOS057
BOS058
BOS060
LOWER INNER HARBOR
FORT POINT CHANNEL
BOS062
BOS064
BOS065
BOS073
BOS072
BOS068
BOS070
FORT POINT CHANNEL STORAGE CONDUIT
BOS079
RESERVED CHANNEL
BOS080
BOS076
BOS078
RESERVED CHANNEL CONSOLIDATION CONDUIT
RESERVED CHANNEL CSO FACILITY
BOS081
COLUMBUS HEADWORKS
BOS085
BOS084
BOS083
BOS082
BOS086
BOS087
NORTH DORCHESTER BAY CONSOLIDATION CONDUIT
NORTH DORCHESTER BAY
CALF PASTURE PUMP STATION
BOS089
FOX POINT UPGRADE
FOX POINT CSO FACILITY
BOS088
SOUTH DORCHESTER BAY
COMMERCIAL POINT UPGRADE
COMMERCIAL POINT CSO FACILITY
BOS090
SOUTH DORCHESTER BAY SEWER SEPARATION
NEPONSET SEWER SEPARATION
NEPONSET RIVER
BOS093
BOS095
SQUANTUM PUMP STATION
Thompson Island
Moon Island
Long Island
WINTHROP TERMINAL HEADWORKS
North Main Pump Station
DEER ISLAND WASTEWATER TREATMENT FACILITY
South System Pump Station
LEGEND
🔴 CSO Outfall Closed as of 2/01
🟡 CSO Outfall To be Closed
🟢 CSO Outfall To Remain
▲ Existing Pump Station
● Existing CSO Treatment Facility
■ Existing Headworks
◆ Proposed CSO Treatment Facility
— Proposed Conduit/Pipeline/Connection
▨ Proposed Sewer Separation Area
CSO PROJECTS
3/2002
Titles of Completed Projects are Labeled in Green

Figure 13. MWRA System-Wide Recommended CSO Control Plan. Graphic courtesy of MWRA.

Between 1983 and 1985, the University of Massachusetts Water Resources Center Acid Rain Monitoring Project used as many as 1,000 citizen volunteers to collect and help analyze more than 40,000 samples from 2,444 lakes and 1,670 streams, respectively 87% and 69% of the named lakes and streams in the state. They also monitored a representative 453 randomly selected and 119 special interest lakes and streams for eight successive years (1985-1993) with approximately 300 volunteers. Results for the nearly comprehensive initial phases of the project show that 5.5% of lakes and streams in Massachusetts are acidified (pH < 5.0 and Acid Neutralizing Capacity (ANC) < 0 μeq/l); 57.4% were sufficiently low in acid neutralizing capacity to be considered threatened by acid deposition (0<ANC<200 μeq/l); and 37.1% were not threatened (ANC > 200 μeq/l). Spring samples contained an average of 45% more Hydronium ions (H+) (pH 6.44 vs. 6.60) and 32% less ANC (257 vs. 376 μeq/l) than fall samples. Lakes were slightly more sensitive than streams. Geographically, higher ANC was typical of extreme western parts of the state and lower ANC was typical of the north-central and southeastern portions. Most lakes and streams exhibited no significant trend for the 10 years of the study. However, 70 of 330 streams showed statistically significant increases in ANC, 11 showed decreases, and 43 of 181 lakes increased in ANC while 7 decreased. Most of the streams and all of the lakes exhibiting statistically significant declines occurred in the southeastern portion of the state. Only three lakes and three streams became acidic (dropped below 0.0 ANC and pH 5.0) during the ten years of the study; five lakes and fifteen streams improved enough that they are no longer acidic (Godfrey *et al.* 1996).

In 2001 and 2002, the Acid Rain Monitoring Project will once again collect samples three times per year (April, July, and October) from approximately 150 lakes and ponds. Samples will be analyzed for pH, alkalinity, total phosphorus and ions. In the Boston Harbor Watershed five sites were sampled in 2001: Hemenway Pond and Pine Tree Pond in Milton, Upper Mystic Lake in Winchester, Ponkapoag Pond in Canton, and Blue Hills Reservoir in Quincy. Additional sites in the Boston Harbor Watershed that were selected but not sampled in 2001 include: Turners Pond in Melrose, Doleful Pond in Stoneham, South Walpole Street Pond in Sharon, Cranberry Pond in Foxborough, Hollingsworth Pond in Braintree, Elias Pond in Weymouth, and Weir River Street Pond in Hingham (Godfrey *et al.* 1996).

In 1994, MDPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* cannot be assessed as support. In July 2001, MDPH issued a new, more inclusive, fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001b).

MDPH is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH has expanded its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b).

MDPH has issued specific advisories on multiple waterbodies in the Boston Harbor Watershed including (MDPH 2001a):

- Mystic River Subwatershed - Clay Pit Pond
- Neponset River Subwatershed - Neponset River and Willet Pond
- Weymouth and Weir River Subwatersheds - Cochato River, Icehouse Pond, and Sylvan Lake
- Boston Harbor Proper, including Quincy Bay (Celona 2001)

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards. Tables 2-5 list the waterbodies in the Boston Harbor Watershed that are on the 1998 Massachusetts Section 303(d) List Of Waters (MA DEP 1999a). Additionally, all freshwaters in Massachusetts are technically (by default) listed in 1998 as 303(d) waters with mercury as the associated stressor/pollutant due to the 1994 MDPH Interim Freshwater Fish Consumption Advisory. This Interim Freshwater Fish Consumption Advisory was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. MDPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially (MDPH 1994).

The MDC Division of Watershed Management manages and protects the drinking water supply watersheds of Quabbin Reservoir, Ware River, and Wachusett Reservoir in central Massachusetts. The reservoirs supply water to the MWRA for distribution to nearly 2.2 million residents of Massachusetts, primarily in Greater Boston. The MDC also manages and protects the Sudbury Reservoir system, which is Greater Boston's emergency back-up water supply (MDC 2002).

Quabbin Reservoir was created in the 1930's to serve the growing needs of Eastern Massachusetts. The Windsor Dam was built to impound the Swift River and flood an area formerly occupied by four Massachusetts towns, Dana, Enfield, Greenwich, and Prescott. Construction on the Quabbin Reservoir began in 1936. Filling commenced on August 14, 1939 and was completed in 1946 when water first flowed over the spillway. The Quabbin Reservoir was filled with water from the Swift River and flood skimming from the Ware River during eight months of the year. At the time, the 412 billion gallon reservoir was the largest man-made reservoir in the world, which was devoted solely to water supply (MWRA 2002).

Water entering Quabbin takes up to four years to circulate and enter the main intake. To reach faucets in Boston, Quabbin Water is released down the 25-mile-long Quabbin Aqueduct to replenish Wachusett Reservoir at Oakdale where it then circulates for eight months before being drawn disinfected at the Cosgrove Intake in Clinton. The water then passes through pipes under the Sudbury Reservoir to Southborough, where fluoride, sodium carbonate (soda ash) and CO_2 (carbon dioxide) are added. The water continues through the Hultman Aqueduct (85% of water) or the Weston Aqueduct (the other 15%), emptying into the Norumbega and Weston Reservoirs. It is then piped into Boston for distribution (MWRA 2002). MWRA is currently building the Walnut Hill Treatment Plant in Marlborough. Once it is completed, the Norumbega and Weston Reservoirs will either be covered or removed from the system and the treated water will be piped from the Walnut Hill Treatment Plant into Boston.

The MetroWest Water Supply Tunnel is a 17.6-mile aqueduct that is being bored through solid bedrock 200 to 500 feet below the communities of Southborough, Marlborough, Framingham, Wayland and Weston. This new tunnel, on schedule for completion in 2003, will greatly improve water transmission reliability and redundancy. When complete in 2003, the MetroWest Water Supply Tunnel will increase the water delivery system's overall capacity by 450 million gallons per day. It will also link MWRA's reservoirs, water treatment, and storage facilities to the City Tunnel and local distribution pipes and to the people that they serve (MWRA 2002).

MYSTIC RIVER SUBWATERSHED

The Mystic River has had significant water quality problems including chemicals leaching from waste disposal sites, contaminated sediments, excessive nutrient inputs, elevated bacteria levels, and storm water runoff. Many of these conditions still prevail today.

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001a):

> The Industri-Plex site is a 245-acre industrial park {located within the Aberjona River subwatershed} that from 1853 to 1931 was used for manufacturing chemicals (e.g., lead-arsenic insecticides, acetic acid, and sulfuric acid) for local textile, leather, and paper manufacturing industries. Chemicals manufactured by other industries at the site include phenol, benzene, and toluene. From 1934 to 1969, the site was used to manufacture glue from raw animal hide and chrome-tanned hide wastes. The by-products and residues from these industries caused the soils within the site to become contaminated with elevated levels of metals, such as arsenic, lead and chrome. From 1969 to 1980, the site was developed for industrial use. Excavation in the 1970's uncovered and mixed industrial by-products and wastes accumulated over 130 years. During this period, residues from animal hide wastes used in the manufacture of glue were relocated on-site from buried pits to piles near swampy areas on the property. Many of the animal hide piles and lagoons on-site were leaching toxic metals into the environment. In the 1980's, the site contained streams and ponds, a warehouse and office buildings, remnant manufacturing buildings, and hide waste deposits buried on the site. Animal hide residues are found on approximately 20 acres of the site in four different piles. Portions of the animal hide piles sloughed off, causing the release of hydrogen sulfide gases to the atmosphere and toxic metals to surrounding wetlands. Residences are located within 1,000 feet of the site,

and more than 34,000 people live within three miles of the site.

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001b):

> Wells G & H were two municipal wells developed in 1964 and 1967 to supplement the water supply of the City of Woburn. The wells supplied 30 percent of the city's drinking water. In 1979, city police discovered several 55-gallon drums of industrial waste abandoned on a vacant lot near the wells; subsequently these drums were removed. As a result of this discovery, the nearby wells were tested and found to be contaminated. Both of the wells were shut down in 1979 and a supplemental water supply arranged for the city. Five separate properties on the site were found to be the contributing sources of contamination to the aquifer that supplied the water to these two municipal wells. The total Superfund site covers an area of 330 acres. The population of Woburn is approximately 36,600 people. The area surrounding the site is predominantly light industrial and residential. Some nonresidential properties involved in the cleanup are fenced to limit unauthorized access. The site includes commercial and industrial parks, as well as recreational areas and some residential gardens. The Aberjona River flows through the middle of the site. Surface water runoff from the site is directed through drainage systems toward the river and its tributaries.

Numerous waterbodies in the Mystic River Subwatershed are currently included in the States 303 (d) List of Impaired Waters due to nutrients, organic enrichment/Low DO, pathogens, and noxious aquatic plants (Table 2).

Table 2. 1998 303(d) List of Impaired Waters: Mystic River Subwatershed

Name (WBID)	Description	Cause of Impairment
Bellevue Pond (MA71004)	Medford	Noxious Aquatic Plants
Black Nook (MA71005)	Cambridge	Nutrients, Noxious aquatic plants
Clay Pit Pond (MA71011)	Belmont	Pesticides
Ell Pond (MA71014)	Melrose	Nutrients, Pathogens, Suspended solids
Horn Pond (MA71019)	Woburn	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants
Judkins Pond (MA71021)	Winchester	Nutrients, Organic enrichment/Low DO, Pathogens
Spy Pond (MA71040)	Arlington	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants
Wedge Pond (MA71045)	Winchester	Nutrients, Noxious aquatic plants
Winter Pond (MA71047)	Winchester	Noxious aquatic plants
Chelsea River (MA71-06)	Confluence with Mill Creek to confluence with Mystic River	Unionized Ammonia, Organic enrichment/Low DO, Pathogens, Oil and grease, Taste, odor, and color, Turbidity
Mystic River (MA71-03)	Amelia Earhart Dam to confluence with Chelsea River (Includes Island End River)	Unionized Ammonia, Organic enrichment/Low DO, Pathogens, Oil and grease, Taste, odor, and color, Turbidity
Alewife Brook (MA71-04)	Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville	Pathogens
Mystic River* (MA71-02)	Outlet Lower Mystic Lake, Arlington to Amelia Earhart Dam, Somerville	Metals, Nutrients, Pathogens
Malden River* (MA71-05)	Headwaters, Malden to confluence with Mystic River, Everett/Medford	Organic enrichment/Low DO, Pathogens, Suspended Solids
Aberjona River* (MA71-01)	Source in Reading to inlet Upper Mystic Lake, Winchester	Unionized Ammonia, Organic enrichment/Low DO, Pathogens

*needs confirmation (additional data collection is necessary to confirm the presence of impairment)

NEPONSET RIVER SUBWATERSHED

Historically industry, including many textile, paper, and lumber mills, thrived along the Neponset River. It was not long before the river gained a justly deserved reputation as highly polluted, with numerous untreated sewage and industrial discharges. Although the water quality problems were recognized in the late 1800's, it was not until the passage of state and federal legislation in the 1960's and 1970's that water quality issues were more seriously addressed. Today, the seventeenth, eighteenth, and nineteenth century mills have closed, connected to the sewer system, or installed waste treatment facilities. Great improvements have been made in the management of residential wastewater as well. While the Neponset River subwatershed has experienced dramatic improvements in water quality, "streamflow" or water quantity has not received as much attention, and it has become an issue of critical concern as communities continue to divert more water from aquifers and the river (NepRWA undated).

In the Neponset River Subwatershed, 38 waterbodies are listed on the States 303 (d) List of Impaired Waters. Sixteen of the 20 lakes included on the list are impaired due to noxious aquatic plants and 16 of the 18 river/estuaries are impaired due to pathogens (Table 3).

Table 3. 1998 303(d) List of Impaired Waters: Neponset River Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Bird Pond (MA73002)	Walpole	Priority organics, Noxious aquatic plants
Russell Pond (MA73003)	Milton	Noxious aquatic plants, Turbidity
Bolivar Pond (MA73005)	Canton	Turbidity
Cobbs Pond (MA73009)	Walpole	Noxious aquatic plants
Crackrock Pond (MA73010)		Noxious aquatic plants
Diamond Pond (MA73012)	Walpole	Noxious aquatic plants
Flynns Pond (MA73019)	Medfield	Noxious aquatic plants
Forge Pond (MA73020)	Canton	Turbidity
Lymans Pond (MA73021)	Westwood	Noxious aquatic plants
Hammer Shop Pond (MA73023)	Sharon	Noxious aquatic plants
Manns Pond (MA73028)	Sharon	Turbidity
Neponset Reservoir (MA73034)	Foxborough	Noxious aquatic plants, Turbidity
Ganawatte Farm Pond (MA73037)	Walpole/Sharon/Foxborough	Noxious aquatic plants
Farrington Pond (MA73040)	Stoughton	Noxious aquatic plants
Plimpton Pond South (MA73042)	Walpole	Priority organics, Flow alteration
Popes Pond (MA73044)	Milton	Noxious aquatic plants, Turbidity
Woods Pond (MA73055)	Stoughton	Noxious aquatic plants
Town Pond (MA73056)	Stoughton	Noxious aquatic plants
Turners Pond (MA73059)	Milton	Turbidity
Memorial Pond (MA73064)	Walpole	Noxious aquatic plants, Turbidity
Mother Brook (MA72-13)	Mother Brook Dam, Dedham to confluence with Neponset River, Boston	Nutrients, Organic enrichment/Low DO, Pathogens
Neponset River (MA73-01)	Outlet of Neponset Reservoir, Foxborough to confluence with East Branch, Canton	Priority organics, Metals, Nutrients, Siltation, Organic enrichment/Low DO, Pathogens, Suspended solids, Noxious aquatic plants, Turbidity
Neponset River (MA73-02)	Confluence with East Branch, Canton to confluence with Mother Brook, Boston	Priority organics, Metals, Organic enrichment/Low DO, Pathogens, Oil and grease, Turbidity
Neponset River (MA73-03)	Confluence with Mother Brook, Boston to Milton Lower Falls Dam, Milton/Boston	Priority organics, Metals, Organic enrichment/Low DO, Pathogens, Oil and grease
Neponset River (MA73-04)	Milton Lower Falls, Milton/Boston to mouth at Dorchester Bay, Boston/Quincy	Organic enrichment/Low DO, Pathogens, Turbidity
Gulliver Creek (MA73-30)	From the confluence Unquity Brook to confluence Neponset River, Milton	Pathogens
Unquity Brook (MA73-26)	Headwaters west of Randolph Ave to confluence with Gulliver Creek, Milton	Organic enrichment/Low DO, Pathogens
Pine Tree Brook (MA73-29)	Outlet of Pine Tree Brook Reservoir through Pope's Pond to confluence Neponset River, Milton	Organic enrichment/Low DO, Other habitat alterations, Pathogens

Table 3 (Continued). 1998 303(d) List of Impaired Waters: Neponset River Subwatershed.

1998 303(d) Listed Waterbody		Cause of Impairment
Ponkapoag Brook (MA73-27)	Outlet of Ponkapoag Pond to confluence with Neponset River, Canton	Pathogens
Purgatory Brook (MA73-24)	Headwaters, Westwood, to confluence with Neponset River, Norwood	Pathogens
Plantingfield Brook (MA73-23)	Headwaters east of Thatcher Street, Westwood, to the confluence with Purgatory Brook, Norwood	Flow alteration
East Branch (MA73-05)	Outlet Forge Pond, Canton to confluence with Neponset River	Cause unknown, Metals, Thermal Modification, Flow alteration, Pathogens
Pequid Brook (MA73-22)	Headwaters east of York Street through Reservoir Pond to the inlet of Forge Pond, Canton	Organic enrichment/Low DO, Pathogens
Massapoag Brook (MA73-21)	Outlet Hammer Shop Pond, Sharon, through Manns Pond, Trowel Shop Pond, and Shepard Pond to the inlet of Forge Pond, Canton	Cause Unknown
Beaver Brook (MA73-19)	Headwaters just were of Moose Hill Street through Sawmill Pond to confluence with Massapoag Brook, Sharon	Organic enrichment/Low DO
Beaver Meadow Brook (MA73-20)	Outlet of Glen Echo Pond, Stoughton, to the inlet of Bolivar Pond, Canton	Organic enrichment/Low DO, Pathogens
Traphole Brook (MA73-17)	Headwaters west of Everett Street, Sharon, to confluence with confluence with Neponset River, Sharon/Norwood	Pathogens
Hawes Brook (MA73-116)	Outlet of Ellis Pond to confluence with Neponset River, Norwood	Pathogens
Germany Brook (MA73-15)	Headwaters, east of Winter Street, to inlet of Ellis Pond, Norwood	Pathogens
Mine Brook (MA73-09)	Outlet of Jewells Pond, Medfield, to the inlet of Turner Pond, Walpole	Organic enrichment/Low DO
Mill Brook (MA73-08)	From Dover/Medfield Border to inlet of Jewell Pond, Medfield	Cause unknown

The Foxborough Company, a former metal plating and manufacturing company that currently is involved in light manufacturing and electronic assembly, discharged process wastewater and sanitary wastewater to the inlet stream of the Neponset Reservoir. The process discharge was connected to the Mansfield WWTP in 1987 and the sanitary discharge was connected in 1989. In 1994, the facility went to a closed-loop system, eliminating its Non Contact Cooling Water (NCCW) discharge. Neponset Reservoir, headwaters of the Neponset River, received the treated process wastewater discharge from Foxborough Company for many years. This discharge contaminated the sediments in the reservoir with heavy metals. The reservoir is currently classified by MA DEP as a (4-0011387) Tier 1A, Phase II hazardous waste site.

WEYMOUTH AND WEIR SUBWATERSHED

From 1925 until its retirement in 1978, Edgar Station was one of Boston Edison Company's three major fossil fuel electrical power generation facilities. Coal fired Units 1, 2 and 3, totaling 160 Milliwatts, were on line by 1929. The plant was expanded in the post-war years with the addition of Unit 4; replicate Units 5 and 6 were added in the early 50's bringing total plant capacity to approximately 400 Milliwatts. Units 4, 5 and 6 fired pulverized coal but were later converted to fire 2.2% sulfur residual oil. All six units used a "once through" cooling water system; the facility was permitted for a heat rejection rate of approximately 4500 million British Thermal Units per hour (MA DEP 22 February 2000).

Edgar Station was retired in 1978 although the property continues to house some electrical transmission facilities and two 12 Milliwatt distillate oil fired simple cycle combustion turbine peaking units. The transmission facilities include Boston Edison Company's switchyard and two underground 115 kilovolts lines. The 115-killvolt lines are owned by New England Electric Systems and provide power to the Quincy area. Boston Edison Company will continue to operate the existing switchyard on a portion of Sithe's property for which it has a permanent easement. Upon retirement, several of the Edgar Station turbine generator sets were removed and sold. The plant's five 250-foot stacks were dismantled in 1993 (MA DEP 22 February 2000).

Excerpted from Baird & McGuire Superfund Site Page developed by MA DEP (MA DEP 13 November 1998):

> The Baird & McGuire Superfund Site is located on South Street near the Holbrook/Randolph line. Eight of the twenty acres comprising the site have been owned by Baird & McGuire, Inc., since 1912. For more than 70 years (from 1912 to 1983), Baird & McGuire operated a chemical manufacturing and batching facility on the property. Activities included mixing, packaging, storing and distribution of various products, including herbicides, pesticides, disinfectants, soaps, floor waxes, and solvents. The property originally included a laboratory, storage and mixing buildings, an office building, and a tank farm. Some of the raw materials used at the site were stored in the tank farm and piped to the laboratory or mixing buildings. Other raw materials were stored in drums. Waste disposal methods at the site included direct discharge into the soil, a nearby brook, wetlands, and a former gravel pit. Hazardous wastes historically were disposed of in an on-site lagoon and cesspool. Also included on site were two lagoons open to rain and large areas of buried wastes such as cans, debris, lab bottles, and hundreds of bottles of chemicals. The lagoon area has been capped with clay. The on-site buildings were in various states of disrepair and unsecured; early activities conducted by EPA included demolishing all but one of the buildings and the tank farms. The tank farm area was temporarily capped. The site is completely fenced and groundwater recirculation system was operated to contain the groundwater plume until permanent remedies were implemented. The site is 500 feet west of the Cochato River. The Cochato River had, at one time, been diverted into the Richardi Reservoir, a water system serving nearly 90,000 people in the Towns of Holbrook, Randolph, and Braintree. Currently, the Cochato River is not being used as a supply source for the Richardi Reservoir. The South Street well field, part of the municipal water supply for Holbrook, is located within 1,500 feet of the site and was shut down in 1982.
>
> The groundwater at the Baird & McGuire Site is contaminated with pesticides and organic and inorganic chemicals. Studies found significant levels of Volatile Organic Compounds (VOCs), other organic compounds, arsenic, and pesticides including DDT and chlordane in Cochato River sediments. Site soils were found to be contaminated with VOCs, polycyclic aromatic hydrocarbons (PAHs), other organic compounds, pesticides, dioxin, and heavy metals such as lead and arsenic. Dioxin also has been detected in area wetland soils. The groundwater discharge is believed to be partially responsible for contamination of Cochato River sediments and adjoining wetlands. Field investigations in 1987 and 1988 determined that contaminated groundwater and surface runoff from the site continue to be the principal sources of contamination of the wetlands adjacent to the site. The investigations defined the contaminants of concern and recommended alternatives for final surface water and sediment cleanup.
>
> *Remedial Activities*
> The Superfund cleanup project at the Baird & McGuire Site is divided into four operable units. The Record of Decision (ROD) for the first two operable units was signed in September 1986; the ROD for the third operable unit was signed in September 1989; and the ROD for the fourth operable unit was signed in September 1990. The goals of the first three operable units are to manage migration and control the source of contamination. The goal of the fourth operable unit is to replace the "Lost Demand" to the Town of Holbrook due to contamination of the South Street Wells.
> *Operable Unit # 1: Groundwater Treatment Plant (GWTP)*
> Construction of the GWTP was completed in 1992. This treatment plant removes metals and VOCs from the contaminated groundwater at this site. In 1998 new construction at the site involves the addition of new wells to pump contaminated groundwater as well as to recover Light Non-Aqueous Phase Liquids, which are present in the top layer of the aquifer.
> *Operable Unit # 2: Contaminated Soil Incineration*
> The soils at Baird & McGuire were contaminated with creosotes, VOCs, pesticides, herbicides and metals (arsenic and lead). This soil was incinerated over a two-year period, from 1995 through 1997, to destroy the organic compounds. Incinerated ash was tested to insure that the metals would not

leach into the groundwater. The site is now graded, topsoil placed and upland areas seeded. Wetlands on site have been restored and planted.

Operable Unit # 3: Cochato River Sediment Dredging

The Cochato River, which is located downstream of the site, was dredged to remove contaminated sediments. Approximately 1,500 cubic yards of these sediments were treated in the incinerator. Sediment and fish sampling continues on an annual basis. The investigations also determined that site contaminants were being effectively trapped in river sediments and were not migrating down-river. In late 1989, a remedy was selected that included excavating and incinerating 1,500 cubic yards of sediments on site. Design of cleanup actions was completed in 1991. Construction activities were completed in 1995. A total of 4,712 cubic yards of contaminated sediment were removed from the river. Annual sampling of the river sediments and five year sampling of fish in the river and in Sylvan Lake will continue for 30 years to ensure that contaminant levels do not increase. Frequency of sampling may decrease after year five if contaminant levels decrease significantly.

Operable Unit # 4: Donna Road Water Supply

To replace the "lost demand" of the South Street Wells contaminated by Baird & McGuire, the ROD determined that the Donna Road Aquifer should be developed to supply the Town of Holbrook with 310,000 gallons per day. The design of the treatment system for manganese and iron began in 1991 and was completed in 1994. Due to a request from the town, the redesign of the treatment facility to include automated operation began in 1998.

Sanitary sewer overflows have been a chronic problem in the Weymouth Fore River and Back River watersheds contributing to violations of water quality standards, particularly during periods of high groundwater after rain events. These overflows have been in areas of public water supplies, shellfish beds, and bathing beaches. The overflows have occurred from the municipal sewer systems, as well as the MWRA interceptor system serving the communities on the South Shore. The primary causes of the sewer overflows are hydraulic deficiencies in the MWRA system and the municipal systems, excessive amounts of infiltration and inflow getting into the municipal systems, and poor operation and maintenance of the municipal systems (Chretien 2002).

DEP began an initiative in 1998 that continues through today to reduce the frequency, duration, and volumes of overflows from the MWRA Braintree-Weymouth Interceptor and the Braintree and Weymouth municipal sewer systems. Braintree and Weymouth are the two largest municipal systems contributing excessive amounts of infiltration and inflow into the MWRA Braintree-Weymouth Interceptor. In assessing compliance, DEP considers each day that an overflow occurs from each different point in a sewer system as a separate “event” and constitutes a separate violation of Department regulations (Chretien 2002).

In the Town of Weymouth, overflows have occurred to Whitman’s Pond, Mill River, Back River, Fore River, Old Swamp River, and other undetermined locations. A total of 530 overflow events occurred from 1992 to March 1999. Overflows have occurred, at least, at the following locations: Westlake Drive Easement, Ruggiano Circle, Montcalm Street, Neck Street Pump Station (Fort Point), Route 3 clover leaf at Main Street, Summer Street Ejector Station, Roseen Avenue, Weymouth Landing at Brookside Rd., Weymouth Landing at Washington St. and Front Street, Middle Street, Cynthia Circle, Pine Street at Pleasant Street, Todd Lane, Belmont Street Ejector Station, Weymouth Commons, Essex Street and Essex Street easement, Meetinghouse Lane, Westlake Drive, Fort Point Road, Blossom Lane, Idlewell Boulevard, Old Country Way, Winter Street easement, Essex Heights Drive easement, Thicket Street Ejector Station, Woodbine Road Ejector Station, Bridge Street, Oakdale Road, Moreland Road, Abigail Adams Circle, Laudervale Road, Biscayne Avenue, Seminole Avenue, and Hibiscus Avenue (Chretien 2002).

In the Town of Braintree, sanitary sewer overflows have occurred at various locations throughout the Town including the Howard Street Pumping Station, the Allen Street Siphon, Trotters Green, the Beach Front area, Surrey Lane, Union Street, the Common Street Pump Station, Bestick Road, the Grove Street Pump Station, the Brookside Road Pump Station, and Prospect Street. These overflows have discharged to the Fore River and the Monatiquot River. There were more than 120 overflow events from 1993 to 1999 (Chretien 2002).

Under certain wet weather flow conditions, overflows from the existing MWRA regional sewer system have discharged into the Fore River, Monatiquot River and Smelt Brook. The MWRA Smelt Brook Siphon has been the most significant location of overflows resulting from surcharging in the MWRA system caused by excessive wet weather flows being contributed by the Towns of Weymouth, Braintree, Randolph, Holbrook, and Hingham. Since 1996 the MWRA Smelt Brook Siphon has overflowed several times each year and has overflowed for periods of up to 11 days on certain occasions (Chretien 2002).

In 1993, MWRA identified hydraulic deficiencies in their own sewer system serving the communities of Braintree, Weymouth, Holbrook, Randolph, and Hingham. MWRA had not yet started construction in 1998 to eliminate these hydraulic deficiencies. In order to ensure construction on a specified schedule, DEP signed an ACO with the MWRA requiring that the MWRA construct the Braintree-Weymouth Relief Facilities. DEP presently oversees compliance of the $175 million MWRA construction project that will increase existing sewer service capacity for the member communities from 55 MGD to 73 MGD by July 2003 (Chretien 2002).

In 1999, Braintree and Weymouth signed ACOs with DEP to address their own sewer system improvements. As an outcome of the ACO with the Town of Weymouth, the Town will be undertaking a $15 million capital improvement project in addition to extensive infiltration and inflow removal work. Both Braintree and Weymouth have identified and removed hundreds of illegal sump pumps. As required by the ACO with DEP, Braintree has also undertaken substantial infiltration reduction projects (Chretien 2002).

The Town of Randolph, the next largest community tributary to the MWRA Braintree-Weymouth Interceptor, received $210,000 from the Clean Water State Revolving Fund (SRF) in 2002 to perform a sewer investigation in the Amelian Road area, which had also been a site of severe sewer overflows in March 2001 (Chretien 2002).

The Town of Weymouth obtained $360,000 of funding from the Clean Water SRF to develop a Stormwater Management Plan intended to support the Town's compliance with EPA Phase II Storm water requirements (Chretien 2002).

Both Braintree and Weymouth were required to perform dry weather sampling of storm drains as part of the sewer ACO with DEP. The dry weather sampling is intended to identify and eliminate any possible illegal connections of sanitary waste to the storm drain system (Chretien 2002).

In the Weymouth and Weir Subwatershed, 17 waterbodies are included on the States 303 (d) List of Impaired Waters, most due to noxious aquatic plants, organic enrichment/low DO, and/or pathogens (Table 4).

Table 4. 1998 303(d) List of Impaired Waters: Weymouth and Weir Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Foundry Pond (MA74011)	Hingham	Nutrients, Siltation, Noxious aquatic plants
Lake Holbrook (MA74013)	Holbrook	Noxious aquatic plants
Old Quincy Reservoir (MA74017)	Braintree	Noxious aquatic plants
Sylvan Lake (MA74021)	Holbrook	Pesticides, Priority organics
Ice House Pond (MA74028)	(No description)	Pesticides
Weymouth Fore River (MA74-14)	Route 53 to mouth	Pathogens
Cochato River (MA74-06)	Outlet Lake Holbrook to confluence with Farm and Monatiquot Rivers	Pesticides, Organic enrichment/Low DO, Pathogens
Weymouth Back River (MA74-13)	Bay Colony Railroad tracks to the mouth	Pathogens
Weir River (MA74-11)	Rockland Street and outlet Straits Pond to mouth at Worlds End	Pathogens
Town River Bay (MA74-15)	(No description)	Organic enrichment/Low DO, Pathogens

Table 4. (Continued.) 1998 303(d) List of Impaired Waters: Weymouth and Weir Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Furnace Brook* (MA74-10)	From headwaters near Chickatawbut Road to confluence with Blacks Creek	Organic enrichment/Low DO
Monatiquoit River*(MA74-08)	Confluence with Cochato and Farm rivers to confluence with Weymouth Fore River	Organic enrichment/Low DO, Pathogens
Weymouth Back River* (MA74-05)	Outlet Whitmans Pond to tidal area	Organic enrichment/Low DO, Pathogens
Mill River* (MA74-04)	Outlet Weymouth Great Pond to inlet Whitmans Pond	Nutrients, Pathogens, Noxious aquatic plants
Old Swamp River* (MA74-03)	Headwaters to inlet Whitmans Pond	Pathogens
Weir River* (MA74-02)	Confluence with Crooked Meadow River and Fulling Mill Brook to tidal area	Nutrients, Pathogens
Crooked Meadow River* (MA74-01)	Outlet Cushing Pond to confluence with Weir River	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants

*needs confirmation (additional data collection is necessary to confirm the presence of impairment)

BOSTON HARBOR (PROPER) SUBWATERSHED

Boston Harbor has been the recipient of over 350 years of solid and liquid wastes. Twenty-six years after the founding of Boston, city regulations for the disposal of waste demanded that solid wastes be deposited into the harbor only on an outgoing tide at Mill Creek. This disposal procedure was to continue for the next 325 years. During the 19th century the City of Boston designed and constructed a sewage elimination system. The system carried raw sewage from the various shoreline communities into the harbor. The majority of raw sewage discharges were eventually curtailed by the mid-1960s. Effluent was then piped to the recently constructed facilities on Deer and Nut Islands. Both of these facilities were initially designed as primary treatment facilities. Each would separate solid wastes from the waste stream. Primary treated wastewater was allowed to flow into the harbor. The solids were collected, digested, and released to the harbor on an outgoing tide. The Deer Island sludge outfall was located on the north side of Presidents Road. The Nut Island sludge discharge was located on the southeastern side of Presidents Road, near Long Island. This discharge technique was sometimes less than effective at Nut Island, as an eddy off of Long Island would retain the discharged solids and transport them into the harbor on an incoming tide (Gallagher and Keay 1998).

The MWRA Boston Harbor benthic monitoring program has documented the recovery of benthic communities in areas of Boston Harbor as improvements are made to the quality of wastewater discharges. A summary of the improvements follows:

- cessation of sludge discharge into the Harbor - 1991
- operation of a new primary treatment facility at Deer Island - 1995
- initiation of secondary treatment (first battery) - 1997
- continuation of secondary treatment implementation (second battery) - 1998
- cessation of effluent discharge from Nut Island and its transfer to Deer Island - 1998
- cessation of effluent discharge to Boston Harbor - 2000

The observed changes in the structure of the Harbor's infaunal communities, coupled with data from sediment profile image studies, provide good evidence for improvement in the condition of benthic habitats in the Harbor since the cessation of sludge discharge in 1991. Most notable was the dramatic increase in abundance and geographic spread of the amphipod *Ampelisca* spp. Also important was the general increase in infaunal abundance and species numbers that occurred after 1991 (Kropp et al. 2000).

Spectacle Island, one of the many Boston Harbor Islands, is jointly owned by the City of Boston and the Commonwealth of Massachusetts, Department of Environmental Management. The island's original shape, two drumlins joined by a narrow sidebar, resembled a pair of spectacles and gave the island its name. Native Americans used the island to fish, harvest clams, and gather other food. After 1660, colonists used the island for pastureland and timber. Between 1717 and 1737, the island housed a quarantine hospital for patients with infectious diseases. In 1847, two resort hotels with casinos were built. Later uses included horse rendering and reclaiming grease from garbage. The City dumped garbage on the island until 1959. Leachate from the landfill contributed to harbor pollution. In 1978, DEM acquired a privately owned portion of Spectacle Island. Throughout the 1980s, extensive planning and permitting resulted in an agreement to deposit 3.6 million cubic yards of filling and excavated materials from the Central Artery/Tunnel project. Spectacle Island will be the water-transportation hub and orientation center for information about the Boston Harbor Island National Park Area. Spectacle Island Park, which will include a visitor's center, two sandy beaches, a marina, and spectacular 360-degree views of Boston Harbor, will be managed by a partnership including the City, DEM, New England Aquarium, Modern Continental, and the University of Massachusetts Urban Harbors Institute (City of Boston 2000b).

In Boston Harbor (Proper), ten segments are on the States 303 (d) List of Impaired Waters due to pathogens (Table 5).

Table 5. 1998 303(d) List of Impaired Waters: Boston Harbor Proper

1998 303(d) Listed Waterbody		Cause of Impairment
Boston Harbor (MA70-01)	Includes President Roads and Nantasket Roads	Pathogens
Boston Inner Harbor (MA70-02)	Includes Fort Point Channel and Reserved Channel	Pathogens
Dorchester Bay (MA70-03)	(No description)	Pathogens
Quincy Bay (MA70-04)	From Bromfield Street near the Wallaston Yacht Club north to buoy C"1" southeast to the "Willows" (also known as Lord's Point) on the northerly shore of Houghs Neck, Quincy	Pathogens
Quincy Bay (MA70-05)	Portion not designed SA	Pathogens
Hingham Bay (MA70-06)	Vicinity of Nut Island Treatment Plant	Pathogens
Hingham Bay (MA70-07)	(No description)	Pathogens
Hingham Harbor (MA70-08)	(No description)	Pathogens
Hull Bay (MA70-09)	(No description)	Pathogens
Winthrop Bay (MA70-10)	(No description)	Pathogens

SOURCES OF INFORMATION

Multiple federal, state, and local agencies provided information used in the water quality assessment of Boston Harbor. Within the Department of Environmental Protection information was obtained from three programmatic bureaus: Bureau of Resource Protection (see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, water quality, habitat assessment, and biological data were provided by the Bureau of Resource Protection, Division of Watershed Management (DWM) Watershed Planning Program. MA DEP's Northeast Regional Office and the DWM Watershed Permitting Program provided water withdrawal and wastewater discharge permit information. [Note: The Bureau of Resource Protection DWM Drinking Water Program evaluates the status of the *Drinking Water Use* and this information is therefore not provided in this assessment report.]

Federal

The U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program is designed to assess historical, current, and future water-quality conditions in representative river basins and aquifers nationwide. One of the primary objectives of the program is to describe relations between natural factors, human activities, and water-quality conditions and to define those factors that most affect water quality in different parts of the Nation. The NAWQA Program's unique design provides consistent and comparable information on water resources in 60 important river basins and aquifers across the Nation. Together, these areas account for 60 to 70 percent of the Nation's water use and population served by public water supplies and cover about one-half of the land area of the Nation (http://water.usgs.gov/nawqa/). USGS sampled the Aberjona River at Winchester and the Neponset River at Norwood from October 1998 through September 1999 as part of the NAWQA Program New England Coastal Basins Study unit. These data are published in the Water Resources Data Massachusetts and Rhode Island Water Year 1999 and 2000 reports (Socolow *et al.* 2000 and Socolow *et al.* 2001).

A New England Coastal Basin (NECB) Mercury Study was also initiated by USGS in 1999 when the results of their National Mercury Pilot Study showed some of the highest mercury concentrations in the country were in the NECB study area (USGS 13 June 2001). The dominant source of mercury identified in the NECB study area was atmospheric deposition. In collaboration with USGS's Toxics Substances Hydrology Program (an extension of the National Mercury Pilot Study), Urban Land Use Gradient Study (part of the NAWQA program) and the MA DEP Merrimack Valley Fish Study, USGS collected sediment, water, and/or fish tissue for total and/or methyl mercury analysis from 22 streams north of Boston in 1999 and 30 sites in the NECB in 2000. Both the Neponset River at Norwood and the Aberjona River at Winchester were sampled by USGS between September 1998 and August 2000.

As part of Massachusetts Watershed Initiative Project 99-02/MWI, USGS conducted surveys in the Boston Harbor Watershed on nine streams: Aberjona River near Woburn, Aberjona River at Washington Street, near Winchester, Aberjona River at Winchester; Mill Brook at Arlington; Mystic River at Medford, Mystic River at Main St., Medford; Alewife Brook near Arlington; Monatiquot River at East Braintree; Town Brook at Quincy; Old Swamp River near South Weymouth; Weymouth Back River at East Weymouth; and Weir River at Rt. 3A Bridge near Hingham. Water quality data collected during May, June, July, and September for water years 1998-1999 included discharge (cfs), barometric pressure, pH, specific conductance, dissolved oxygen, air and water temperature, fecal coliform and *E. coli* bacteria, and nutrients (ammonia/nitrogen, phosphorus) (Socolow *et al.* 2000 and Socolow *et al.* 2001).

According to climate statistics collected by NOAA, 1999 was the driest growing season on record in several northeast states, including Massachusetts. Additionally, streamflow data collected by the U.S. Geological Survey showed that the average monthly stream flows in the summer were lower than have been recorded in decades. Data from 30 USGS streamflow stations, each having more than 40 years of measurements, showed the lowest average flow recorded for June at ten of the stations (USGS 5 June 2001).

The United States Army Corps of Engineers (ACOE) New England Division conducted a use attainability study of the East Branch Neponset River subwatershed in 1996 to examine high water temperatures during summer months. The study concluded that instream temperatures were affected by numerous impoundments, dams, wetland areas, and general low flows. The study determined that by increasing flows and decreasing open unshaded areas, water temperatures could potentially be lowered (ACOE 1998). ACOE is currently involved in many projects in the Boston Harbor Watershed including: the Town Brook flood control protection project in the Towns of Braintree and Quincy, dredging the Mystic River, Reserve Channel, and Chelsea Creek, a feasibility study of salt marsh restoration in Broad Meadows in Quincy, Billings Creek coastal wetlands study in the Neponset Subwatershed, and a habitat restoration project on the Neponset River involving the removal of the Walter Baker and Tilestone and Hollingsworth dams (ACOE 31 October 2001).

State
Many of the rivers in the Boston Harbor Watershed receive the discharge of treated municipal and industrial wastewater, contact and non-contact cooling water.

Waste Water Treatment Plants (WWTPs): There are two WWTP's that discharge into the Boston Harbor Watershed. These facilities treat wastewater from domestic and industrial sources within the WWTP service area (MA DEP 2001c).

- The **Town of Hull (MA0101231)** is permitted to discharge 3.07 million gallons per day (MGD) to the Boston Harbor/Atlantic Ocean. The current permit includes secondary limits: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) = 30 mg/L; fecal coliform bacteria = 200 cfu/100mL; and LC_{50} = 100%. This permit is scheduled to be reissued in Spring 2002.

- The **Massachusetts Water Resource Authority Deer Island Facility's (MA01013284)** peak capacity is 1.27 billion gallons of wastewater per day with a dry weather flow limit of 436 MGD. Average daily flow is about 380 MGD. The permit includes limits for: Chemical Biological Oxygen Demand (CBOD)= 25 mg/L; TSS = 30 mg/L; fecal coliform bacteria = 14,000 cfu/100mL; LC_{50} = 50%; and CNOEC = 1.5%. The permit also includes several additional requirements including: ambient monitoring, contingency plan, water conservation within service area, pollution prevention, and industrial pre-treatment program (Hogan 2001).

  Wastewater "influent" from MWRA's 43 customer communities arrives at the Deer Island Facility through four underground tunnels. At the plant, there are three main pump stations: North Main

Pump Station and the Winthrop Terminal Headworks (capacity 910 MGD) and the Lydia Goodhue Pump Station with an additional capacity of 360 MGD. The pumping capacity at the new Deer Island plant has increased the volume of wastewater that can be taken into the plant from the conveyance tunnels. This can significantly reduce back-ups and overflows throughout the system due to storm events and reduces CSOs (MWRA 13 December 2001).

After pumping, the wastewater receives primary treatment through various settling procedures. Secondary treatment mixers, reactors and clarifiers remove non-settleable solids through biological and gravity treatment. The implementation of this secondary treatment began in 1997. A second "battery" of treatment was completed in 1998 and the third was completed in 2001. Sludge and scum from both levels of treatment are thickened and digested. One of the by-products of this process, methane gas, is used in the plant's on-site power generating facility. Digested sludge leaves Deer Island by barge for MWRA's Pelletizing Facility at Fore River in Quincy, where it is further processed into a fertilizer product (MWRA 13 December 2001).

After passing through primary and secondary treatment, wastewater is disinfected with sodium hypochlorite to kill bacteria. After disinfection and dechlorination, the effluent is discharged via a 9.5-mile 24-foot-diameter outfall tunnel into Massachusetts Bay. More than 50 individual diffuser pipes, each with eight small ports, are employed to achieve rapid and thorough mixing into surrounding water (MWRA 13 December 2001).

Combined Sewer Overflows (CSOs): There are five permittees discharging CSO into the Boston Harbor Watershed: the cities of Chelsea, Somerville, and Cambridge; Boston Water & Sewer Commission; and the MWRA (Brander 2001a).

- **City of Chelsea (MA0101877)** discharges via four CSO locations within the Mystic River Subwatershed: one to Mystic River, three to Chelsea River. The permit expired 13 August 1998 and EPA expects to re-issue in 2002.
- **City of Somerville (MA01101982)** is permitted to discharge via eight CSO locations within the Mystic River Subwatershed; six of the CSO outfalls have been eliminated. Of the remaining two, one discharges to Alewife Brook and one to the Mystic River. The permit expired 29 September 1997. The permit is expected to be reissued in 2002.
- **City of Cambridge (MA0101974)** discharges via 11 CSO locations; six within the Mystic River Subwatershed (Alewife Brook) and five to the Charles River in the Charles River Basin. The permit expired 25 April 1998. The permit is expected to be reissued in 2002.
- **Boston Water & Sewer Commission (MA01011992)** discharges via 53 CSO locations to Boston Harbor Watershed including the Mystic, Charles, and Muddy rivers, Fort Point and Reserved channels, and Boston Harbor Proper. The permit expired 29 September 1992. The permit is expected to be reissued in 2002.
- **MWRA (MA0103284)** discharges via 15 CSO locations: four to Boston Harbor; one to Alewife Brook; two to Mystic River; and seven to Charles River.

Power Plants (MA DEP 2001c): There are several power generation facilities within the Boston Harbor Watershed.

- **Sithe-Mystic (MA0004740)** discharges 754 MGD from four power generation units to Mystic River subwatershed. The permit contains a 93 °F temperature limit and a 0.1mg/L total residual chlorine limit (one unit at a time discharging for a maximum of two hours). The permit was reissued in 2001.
- **Sithe-New Boston Station (MA0004731)** has two condenser cooling water discharges (258 and 232 MGD) to the Boston harbor proper. The permit contains a 96 °F temperature limit with a $\leq$ 25 °F temperature change. The permit expired on 15 January 1999. The permit is expected to be reissued in 2003.
- **Braintree Electric Light Department- Potter Cogeneration (MA0005517)** discharges ancillary water from the cogeneration plant to Weymouth and Weir subwatersheds. The permit expires 20 March 2005.
- **Cabot Power- Island End Cogeneration, Everett, (MA0040126)** discharges 40,000 GPD of floor drain and boiler blowdown water to the Mystic River subwatershed. The facility has a total suspended solid (TSS) limit of 30mg/L. The permit was issued 19 May 2000.

Oil Terminals (MA DEP 2001c)*:* There are multiple oil terminals located within the Boston Harbor Watershed. There are two approaches to oil terminal NPDES permit limits. The first approach includes a TSS limit of 30 mg/L; an oil & grease limit of 15 mg/L; a benzene limit of 500 µg/L; flow reporting requirements; and PAH monitoring requirements. The second approach also includes secondary limits of PAHs (31ng/L) (Hogan 2001).

Permitted facilities in the Boston Harbor Watershed include:

- **Citgo Petroleum, (MA0004782)**
- **Exxon Terminal, Everett (MA0000833)**
- **Gulf Oil, Chelsea (MA0001091)**
- **Chelsea Sandwich (MA0003280)**
- **Global Oil Terminal, Revere (MA0000825)**
- **Irving Oil Terminal, Revere (MA0001829)**
- **Global Revco Terminal, Revere (MA3298)**
- **Global Petroleum Corp., Revere (MA0003425)**
- **Coastal Oil New England, S. Boston (MA0004405)**
- **TOSCO East Boston Terminal (MA0004006)**

The Central Artery Tunnel Project Discharges (MA DEP 2001c) resulting from the "Big Dig" include:

- **Massachusetts Bay Transit Authority (MBTA)- South Boston Piers/Transitway Project (MA0036781)** is permitted to discharge construction dewatering via eight outfalls to the Boston Harbor Proper. The permit has a TSS limit of 100 mg/L (average) and a 250 mg/L daily maximum: and a Total Petroleum Hydrocarbon (TPH) limit of 5 mg/L. The permit also requires a Best Management Practices (BMP) Plan and expires 12 August 2002.
- **Massachusetts Highway Department (MA0033928)** is permitted to discharge construction dewatering via 45 outfalls, only a small portion of which are operational at any one time, to the Boston Harbor Proper. The permit includes both dry and wet weather monitoring requirements and limits. During dry weather conditions the TSS limit is 100 mg/L, average and 250 mg/L daily maximum. During wet weather condition MassHighway is required to monitor only for TSS. The TPH limit during both wet and dry weather conditions is 5 mg/L. Under this permit a storm water pollution prevention plan (SWPPP) is required. The permit expires 21 December 2002.

Other Industrial Discharges (MA DEP 2001c): The majority of industrial process wastewaters are treated at WWTPs under conditions of their industrial pre-treatment program. This program is controlled by the municipality and is a condition of the municipal WWTP NPDES permit. There are several industries within the Boston Harbor Watershed that have permits for the discharge of non-contact cooling water (NCCW) and storm water. These discharges can be authorized and controlled under either a general or an individual permit. The list below does not include any general permitted storm water discharges in the Boston Harbor Watershed, as there are too many to list (>50).

- **Gillette Company – Safety Razor Division (MA0003832)** is permitted to discharge 53.1 MGD of NCCW to Boston Harbor Proper. The existing permit includes a maximum temperature limit of 83°F. The permit is currently being reissued with Gillette seeking an increase in flow.
- **UMass Boston** is covered under the EPA general NCCW permit to discharge 8 MGD to the Boston Harbor Proper. This general permit includes an 83°F maximum temperature limit.
- **Olin Corporation, Wilmington (MA0005304)** is permitted to discharge treated groundwater contamination to the Mystic River Subwatershed. The permit includes organics and ammonia limits, an LC_{50} = 100% and a Chronic No Observed Effect Concentration (CNOEC) = 100%. The permit expires 13 March 2005.
- **Plymouth Rubber, Canton (MA0000884)** is permitted to discharge 2.6 MGD of NCCW (with no temperature limit) to the Neponset River Subwatershed. The facility is also permitted to discharge storm water a TSS permit limit of 50 mg/L and a SWPPP is required.
- **Sensor Electronics- Metal Bellows Division (MA00023050)** is permitted to discharge 1500 GPD of plating wastewater (heavy metal limits) and 20,000 GPD NCCW (83°F temperature limit) to the Neponset River Subwatershed. This permit expired on 18 August 1991. The permit is scheduled to be reissued in 2002.

- **Factory Mutual Engineering Corporation, Norwood (MA0003638)** is permitted to discharge sprinkler testing water to the Neponset River Subwatershed. The permit is currently out for review.
- **Baker Process**, (formerly known as **Bird Machine), South Walpole (MA0000230)** is permitted to discharge both storm water (TSS limit of 50 mg/L) and NCCW (83°F temperature limit) to the Neponset River Subwatershed. The permit expired 30 October 2000.
- **Certainteed Inc.**, (formerly known as **Bird Incorporated), Norwood (MA0003531)** is permitted to discharge contact cooling water (temp = 83°F; TSS = 40 mg/L; LC_{50} = 100%), NCCW (TSS = 20 mg/L), and storm water (TSS= 10 mg/L) to the Neponset River Subwatershed. The permit also requires a SWPPP. The permit expires 30 October 2002.
- **Clean Harbors (MA0031551),** a hazardous waste disposal company located in Braintree, is permitted to discharge storm water to the Weir River Subwatershed. The permit includes limits for: TSS= 20 mg/L; oil/grease = 5 mg/L; lead = 5 µg/L; PAH = 10 µg/L; benzene = 5 µg/L; PCB = 1µg/L; and LC_{50} = 100%. The permit is currently being reissued.
- **Avon Custom Mixing Service (MA0026883)** is permitted to discharge NCCW (temp = 85°F) and sanitary wastewater (secondary limits) to the Weir River Subwatershed. The permit expired on 30 October 1991. The permit was reissued and is under appeal.

Storm water
Phase I of the EPA's storm water program was promulgated in 1990 under the Clean Water Act and relies on NPDES permit coverage to address storm water runoff from medium and large municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater, construction activity disturbing five acres of land or greater, and ten categories of industrial activity. Phase II expands the original program to certain small MS4s in urbanized areas and uses six minimum control measures to reduce the discharge of to the maximum extent practicable, protect water quality, and satisfy requirements of the Clean Water Act. The six measures are public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, pollution prevention/good housekeeping. More information on EPA's storm water program is available online at http://cfpub1.epa.gov/npdes/home.cfm?program_id=6.

The City of Boston is a Phase I community. The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system under Phase I and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

All other communities in the Boston Harbor Watershed are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

Site specific evaluations of other water quality issues in Boston Harbor related to either wastewater discharges and/or water withdrawals were conducted by DEP DWM either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports and annual water withdrawal reports submitted by the permittees.

The two WWTP's and eight industrial discharges in the Boston Harbor Watershed submit toxicity testing reports to EPA and MA DEP as required by their NPDES permits. Data from these toxicity reports are maintained by DWM in a database entitled "Toxicity Testing Data - TOXTD". Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and the whole effluent toxicity test results. Data from February 1996 to March 2001 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Boston Harbor Watershed. These include:

- Hull WWTP (MA0101231)
- MWRA Deer and Nut Islands (MA0102351)
- MWRA Mass Bay (MA0103284)
- Monsanto Everett (MA0000809)
- Exxon Everett (MA0000833)
- Olin Chemical (MA0005304)
- Factory Mutual Engineering (MA0003638)
- Bird Roofing (MA0003531) (a.k.a Certainteed)
- MBTA Quincy Pump Station (MA0033987)
- Twin Rivers Technologies L. P. (MA0004073)
- Mobile Oil East Boston (MA000406)

Water Management Act

A list of registered and permitted Water Management Act (WMA) withdrawals (both public water suppliers and other industrial users) is provided in Appendix G, Table G1 (LeVangie 2001).

In cases where water withdrawal information was available, it was included in the segment assessment. In order to determine where stream segments might be affected by water withdrawal activities, a review of the WMA files is necessary. Additionally, there are three facilities that have also applied for a Nonconsumptive Use Status (water they use is discharged at or near the withdrawal point in substantially unimpaired quality and quantity):

- Town of Arlington (dewatering) - Accepted 5 October 2000
- Hollingsworth and Vose Company - Accepted 2 January 1989
- Neponset Reservoir Company - Accepted 31 January 1989

Agency Monitoring

MWRA's monitoring of Boston Harbor, its tributaries, and Massachusetts and Cape Cod bays includes studies on water quality (1993-present), hydrographic data in the Inner Harbor, CSO receiving waters and anthropogenic virus monitoring. The water quality monitoring began in 1993 to document water quality changes as pollution abatement projects are implemented. MWRA collects water quality data from 33 stations in the Boston Harbor Watershed including: chlorophyll, Enterococcus and fecal coliform bacteria, TSS, dissolved oxygen, percent saturation, temperature, turbidity, nutrients (dissolved and/or particulate nitrogen and phosphorus), and Secchi disk depth (Coughlin 2001a and 2002). In addition, MWRA analyzes samples for fecal coliform bacteria from Metropolitan District Commission beaches (41 sampling stations) within the Boston area (Coughlin 2001b). Under their NPDES permit, MWRA is required to monitor the biological communities (fish and benthic) in the Boston Harbor proper.

MWRA's 2000 biomonitoring program for fish and shellfish represents the final year of baseline monitoring (Lefkovitz et al. 2001). All 2000 fish and shellfish samples were collected before the new outfall went on-line in September 2000. The goal of this program was to obtain data that may be used to identify potential environmental impacts of the effluent discharge on Massachusetts Bay, and to evaluate the facility's compliance with their NPDES discharge permit.

Monitoring was also conducted to further define the baseline conditions of three indicator species winter flounder (*Pseudopleuronectes americanus*), lobster (*Homarus americanus*), and blue mussel (*Mytilus edulis*). Specimens were collected from three core sites in Boston Harbor and the Bays: Deer Island Flats, the Outfall Site, and East Cape Cod Bay. Additionally, flounder were collected at two ancillary sites, Broad Sound (BS) and off Nantasket Beach, to provide information on flounder in the general area of the former Deer Island outfall. Caged mussels, collected from Rockport, MA, were deployed at three sites (Boston Harbor, Cape Cod Bay and Massachusetts Bay) to evaluate the potential for bioaccumulation (Lefkovitz *et al.* 2001).

The species collected were characterized in terms of biological parameters (e.g., length, weight, age); external condition; and concentrations of organic and inorganic compounds in both edible and liver/hepatopancreas tissue. Flounder livers were also examined for the extent and severity of lesions. In addition, body burdens of pesticides (PCBs, lead and mercury) were compared to the Food and Drug Administration Action Limits and MWRA's Appreciable Change levels to evaluate potential risk or trends (Lefkovitz *et al.* 2001).

The MWRA Boston Harbor benthic monitoring program includes three components: sediment profile images, sediment geochemistry and infaunal communities (Kropp *et al.* 2000). MWRA began its studies of the infaunal communities and benthic habitats in Boston Harbor in 1991, just prior to the cessation of sludge dumping into the Harbor. The principle aim of the Harbor studies is documentation of continuing recovery of benthic communities in areas of Boston Harbor as improvements are made to the quality of wastewater discharges (Kropp *et al.* 2000).

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (MDPH), the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) Division of Fisheries and Wildlife (MassWildlife), its Riverways Program and its Department of Marine Fisheries (DMF), the Department of Environmental Management (MA DEM), Office of Coastal Zone Management (CZM), and Metropolitan District Commission (MDC).

Local/Citizen Monitoring

In addition to state and federal agencies, regional, local, and citizen monitoring groups provide data/information for the watershed management process that may be used to indicate areas of both high and degraded water quality, as well as causes and sources of contamination.

The Mystic River Watershed Association (MyRWA) is a grass roots membership organization that advocates for protection of the waters and related resources in the basin's 21 communities. The mission of the Mystic River Watershed Association is to restore clean water in the Mystic River watershed, protect its waters and related natural resources, and establish programs of public information and education to these ends. MyRWA strives to be an "umbrella" organization by forging linkages with other citizens' groups, businesses and government agencies to address the critical environmental issues in the watershed (MyRWA Undated).

From July 2000 to December 2000, MyRWA sampled water quality as part of the Mystic Monitoring Network on the Aberjona River, Alewife Brook, Malden River, Meetinghouse Brook, Mill Brook, Mystic River, Upper Mystic Lake, and Winn Brook. Parameters measured include fecal coliform bacteria, TSS, nitrite, nitrate, total phosphorus, conductivity, pH, dissolved oxygen, water temperature as well as observations of water color, odor, and general description of the sample area (MyRWA 2001).

The MyRWA, with support of the DFWELE Riverways Program, has also organized Stream Teams in various subwatersheds since 1995 to establish stewardship of streams by local citizens, schools, businesses and civic groups. These include: Alewife/Mystic River Advocates, Friends of the Mystic River and the Alewife Brook/ Little River Stream Team (DFWELE 28 July 1999).

The Alewife/Mystic River Advocates and the Friends of the Mystic River conducted shoreline surveys of the Mystic River, Alewife Brook, and the Malden River during spring 1995 and fall 1996. They noted general water quality such as color, odor, depth, aquatic vegetation; bank conditions; and land use. As part of a section 319 Nonpoint Source Grant awarded to the City of Somerville, Alewife/Mystic River Advocates collected water quality samples from Alewife Brook between November 1999-November 2000. Parameters measured included pH, dissolved oxygen, percent saturation, total dissolved solids, temperature, nitrate-nitrogen, and general shoreline conditions (AMRA 1997).

"The Alewife Brook Stream Team is a citizen advocacy group formed to encourage responsible stewardship of the Alewife Reservation and abutting properties; stewardship that maintains and improves the reservation's role as a habitat resource while encouraging responsible public access" (DFWELE 2000a). This shoreline survey, conducted 3 June 2000, was divided into 21 segments and extended from the Blair Pond and Little Pond, through the Little River and Alewife Brook to the confluence with the Mystic River. Teams noted instances of trash, erosion, land use, pipes, aquatic vegetation, wildlife, and objectionable odors (sewage). Based on their survey, the stream team has developed an Action Plan (DFWELE 2000a).

A concerned citizen, R. Frymire, sampled source pipes in the Alewife Brook, Little River, Wellington Brook, and Little Pond for fecal coliform bacteria during November and December 1999 for MyRWA. Samples were analyzed at the Charles River Watershed Association Laboratory. His results indicated elevated levels of fecal coliform at many of the sampling locations (Frymire 2000).

In 1999, sediment samples were collected from Alewife Brook, Mill Brook (Arlington), and Mystic Lakes for contaminant analysis as part of a Tufts Masters thesis research (Ivushkina 1999). Samples were analyzed using Instrumental Neutron Activation Analysis and Flame Atomic Absorption Spectroscopy for a suite of elemental contaminants.

The Neponset River Watershed Association (NepRWA) is a private nonprofit conservation group made up of citizens, local officials, and local business people. The watershed association works to protect and restore the natural resources of the Neponset River and its watershed for the use and enjoyment of present and future generations. The Watershed Association conducts water quality testing and other kinds of environmental monitoring; it works to clean up pollution sources, to restore anadromous and warm water fisheries, to encourage public access and recreation along the river, to prevent flooding, and to protect key parcels of open space (NepRWA undated).

As part of the Citizen's Water Monitoring Network (CWMN), NepRWA sampled water quality at 39 sites on the Neponset River, Mine Brook, School Meadow Brook, Spring Brook, Germany Brook, Hawes Brook, Meadow Brook, Traphole Brook, Massapoag Brook, Steep Hill Brook, Pequid Brook, East Branch Neponset River, Purgatory Brook, Pecunit Brook, Ponkapoag Brook, Mother Brook, Pine Tree Brook, Unquity Brook and Willett Pond. Parameters measured include fecal coliform bacteria, TSS, nitrite/nitrate, total nitrogen, total phosphorus, orthophosphate, pH, dissolved oxygen, and water temperature. Samples were collected once a month during January, March, May, and July – December (NepRWA 1998, 1999, 2001a and 2001b). In addition, fish population and macroinvertebrate surveys were conducted in conjunction with MA DEP as part of the BUDGETS (Balancing Uses with Demands and Generating Effective Techniques for Sustainability) project (Berasi and Harrahy 2001).

NepRWA, with support of the DFWELE Riverways Program, have also organized Stream Teams in various subwatersheds to establish stewardship of streams by local citizens, schools, businesses and civic groups. These include: Friends of the Neponset Estuary, Canton River Watershed Watchdogs, and the Hawes Brook Preservation Society (DFWELE 28 July 1999).

The Fore River Watershed Association (FRWA) has the goal of improving the water quality in the Fore River and its tributaries in order to return swimming and shellfishing to the river on an unrestricted basis (Franklin 2001). FRWA collected bacteria samples between 23 April 1996 and 20 October 1997 on the Town River, Town Brook, Phillips Creek, Lower Mill Cove, Smelt Brook, and the Montaquot River. Between 14 April and 15 May 1997, FRWA conducted a study to determine the presence of river herring in the Montaquot River.

The Weir River Watershed Association has developed a flow monitoring program of the Weir River and its tributaries in response to concerns regarding impacts from drinking water withdrawals. The goals of the project are to establish a baseline and gain further understanding of the hydrology of the river by measuring water levels and flows at nine stations along the Weir River, Fulling Mill Brook, and Accord Brook over a one year period (Woods 2001).

The Boston Harbor Association with financial support of the Massachusetts Port Authority, the mayor's office, the City of Boston Environment Department, the Massachusetts Water Resources Authority, the United States Environmental Protection Agency, the Massachusetts Environmental Trust, and the Massachusetts Coastal Zone Management, initiated a program, Boston Harbor Marine Debris Salvage Program, to clean up the waterfront and inner tributaries of Boston Harbor. Together, these groups funded daily patrols, and removal of flotsam, from "high activity areas" (the downtown waterfront, the Charlestown Navy Yard, and the East Boston waterfront). Other patrol areas included the South Boston waterfront, the Outer Fort Point Channel, and Chelsea Creek. More than 130 barrels of small debris, 300 pieces of large debris, and 30 pieces of piers and other oversized debris were collected between July 1, 2000 and September 15, 2000 during the 2000 pilot program. The 2001 program expanded the clean-up effort in terms of financing, patrol area, and amount of debris collected. The project funding was increased from $85,000 in 2000 to $125,000 in 2001. The 2001 project added the Charles River and the Mystic River to the patrol area. The 2001 project operated from 18 June to 1 October. The amount of debris removed totaled more than 57 tons in 2001. This project has led to efforts to curtail the entrance of debris from the shore to the harbor. The Boston Conservation Commission and the MA DEP have developed certain conditions to keep waterfront construction debris from entering the harbor. Numerous cleanup projects along the Charles River, the Mystic River, and harbor beaches have also resulted (East Boston 21 August 2000).

Within the Boston Harbor Watershed there are many formal bathing beaches that monitor pollutants that pose a threat to beach water quality. Swimming in unsafe water may result in minor illnesses, such as sore throats or diarrhea, or more serious illnesses such as meningitis, encephalitis, or severe gastroenteritis. Children, the elderly, and people with weakened immune systems have a greater chance of becoming ill when they come in contact with contaminated water. EPA recommends that state and local officials monitor water quality (*E. coli*, *Enterococcus*, and/or fecal coliform bacteria counts) and issue an advisory or closure when beaches are unsafe for swimming. By issuing beach advisories and closings, state and local officials are reducing swimmer exposure to contaminated water and protecting public health (EPA 20 July 2000). Although these samples are not necessarily collected under an approved Quality Assurance Project Plan, MA DEP, after review and validation for quality assurance, use these data, in conjunction with beach closure information, to determine if the waterbodies are meeting their national goals of being swimmable and fishable (assess *Primary* and *Secondary Contact Recreational uses).*

In August 2001, the Massachusetts "Beach Bill" was enacted by the legislature and signed by the Governor (MGL. C111. S5S). This act created minimum standards for public bathing waters adjacent to any public or semi-public bathing beach in the Commonwealth. A "public bathing beach" is defined as a beach open to the general public whether or not any entry fee is charged that permits access to bathing waters. A "semi-public bathing beach" is defined as a bathing beach used in connection with a hotel, motel, trailer park, campground, apartment house, condominium, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the bathing beach, and where admission to the use of the bathing beach is included in the fee paid for use of the premises. A semi-public bathing beach shall also include a bathing beach operated and maintained solely for the use of members and guests of an organization that maintains such bathing beach. Under the Beach Bill, the Massachusetts Department of Public Health (MDPH) was directed to establish minimum uniform water quality standards for coastal and inland beach waters as well as determining the frequency and location of testing, reporting requirements, and requirements for notifying the public of threats to human health or safety. *105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)* outlines MDPH's guidelines for the Beach Bill and is available online at http://www.state.ma.us/dph/dcs/bb4_01.pdf. Additionally, under the Beach Bill and MDPH guidelines, local boards of health and state agencies are responsible for collecting samples from public beaches using testing procedures consistent with the American Public Health Association's *Standard Methods for Examination of Water and Waste Water* or methods approved by EPA. Operators of semi-public beaches are responsible for the costs of testing their beaches. Results of testing, monitoring, and analysis of public and semi-public beaches must be submitted in an annual report to MDPH by 31 October of each year (MDPH 2002).

TOTAL MAXIMUM DAILY LOADS (TMDL)

As part of the Federal Clean Water Act, states are required to develop total maximum daily loads (TMDLs) for lakes, rivers and coastal waters not meeting the states surface water quality standards as indicated by the states 303d list of impaired waters. A TMDL is the greatest amount of a pollutant that a waterbody can accept and still meet standards. Further information on the 303d list and the TMDL program are available on the MA DEP website at: http://www.dep.state.ma.us/dep/brp/wm/wmpubs.htm.

RIVERS

The Neponset River fecal coliform bacteria Total Maximum Daily Load has been prepared through the collective efforts of the EPA and the MA DEP as well as support from local stakeholder groups (MA DEP 2001d). Data collected by MA DEP and NepRWA, beginning in 1994 to the present, document consistent exceedances of fecal coliform standards. In order to prevent further degradation in water quality and to ensure that the Neponset River meets state water quality standards, this TMDL will outline corrective actions to achieve that goal. This TMDL will not address other pollutants identified on the 303(d) list that may be contributing to the non-attainment of Surface Water Quality Standards. Additional TMDL reports will be prepared, as necessary, to address those pollutants in the future.

A basin-wide implementation strategy is proposed to implement the fecal coliform TMDLs through the following mechanisms:

- Development of comprehensive storm water management programs including identification and implementation of Best Management Practices (BMPs)
- Illicit Discharge Detection and Elimination
- Leaking Sewer Pipes and Sanitary Sewer Overflows
- Inspection and upgrade of on-site sewage disposal systems as needed

LAKES

Within the Mystic, Neponset, and Weymouth & Weir subwatersheds of the Boston Harbor Watershed, there are a total of thirty-four ponds on the 303 (d) list for which the most common cause of impairment is noxious aquatic plants (Tables 2-5). Baseline lake surveys were completed on four ponds in 1999 by DWM for the purpose of TMDL development: **Winter Pond** (MA71047), Winchester in the Mystic River Subwatershed; **Cobbs Pond** (73009), Walpole; **Ganawatte Farm Pond** (MA73037), Walpole/Sharon/Foxborough; and **Turners Pond** (MA73059), Milton in the Neponset River Subwatershed. A draft TMDL for all four ponds is scheduled to be completed in 2006 (Mattson 2002).

In addition, draft phosphorus TMDLs based on previous diagnostic/feasibility studies are being developed for two ponds in the Mystic River Subwatershed -- **Ell Pond** (MA71014), Melrose and **Spy Pond** (MA71040), Arlington and two ponds in the Weymouth & Weir Subwatershed -- **Foundry Pond** (MA74011), Hingham; and **Lake Holbrook** (MA74013), Holbrook. TMDLs for the remaining Boston Harbor Watershed lakes are scheduled to be developed in accordance with the five-year cycle of the Watershed Initiative.

OBJECTIVES

This report summarizes information generated in the Boston Harbor Basin through *Year 1* (information gathering in 1996) and *Year 2* (environmental monitoring in 1997) activities established in the "Five-Year Cycle" of the Watershed Initiative. Data collected by the MA DEP Division of Watershed Management (DWM) in 1999, in accordance with their Quality Assurance Project Plans (MA DEP 1999b, MA DEP 1999c, and MA DEP 1999d), are provided in Appendices A, B, and C (QA/QC, water quality data, and one technical memorandum entitled *Boston Harbor Watershed 1999 Biological Assessment*). Together with other sources of information (identified in each segment assessment), the status of water quality conditions of lakes and streams in the Boston Harbor Basin was assessed in accordance with EPA's and MA DEP's use assessment methods. Not all waters in the Boston Harbor Basin are included in the DEP/EPA Water Body System (WBS) database or this report.

The objectives of this water quality assessment report are to:

1. Evaluate whether or not surface waters in the Boston Harbor Watershed, defined as segments in the WBS database, currently support their designated uses (i.e., meet water quality standards),
2. Identify water withdrawals and/or major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality conditions,
3. Identify the presence or absence of any non-native macrophytes in lakes,
4. Identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. Recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality, and
6. Provide information to the Boston Harbor Watershed team for use in its annual and 5-year watershed action plans.

SEGMENT REPORT FORMAT

RIVERS

The segment order in this assessment report follows the Massachusetts Stream Classification Program (Halliwell *et al.* 1982) hierarchy. Stream segments are organized hydrologically (from most upstream to downstream). Tributary summaries follow the segment into which they discharge. Each segment summary is formatted as follows:

SEGMENT IDENTIFICATION

Name, water body identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number e.g., MA71-01) used by MA DEP to reference the stream segment in databases such as 305(b) and 303(d), the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

Major land-use estimates within Massachusetts (the top three uses for the subwatershed excluding "open water") and other descriptive information.

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a Geographic Information System (GIS) analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1985 and 1990 (UMass Amherst 1999).

SEGMENT LOCATOR MAP

Subbasin map, major river location, segment origin and termination points, and segment drainage area (gray shaded).

Sources of information: MassGIS (MassGIS 2000) data layers (stream segments and quadrangle maps).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

WMA water withdrawal, NPDES wastewater discharge (when provided).

Sources of information: WMA registrants and permittees (LeVangie 2001, O'Keefe 2002); NPDES open permit files located in Worcester DEP Office (MA DEP 2001c); MWRA CSO status (Brander 2001a, 2001b, and 2002); storm water permits (Scarlet 2002).

USE ASSESSMENT

Aquatic Life, Fish Consumption, Drinking Water (where applicable – see note below), *Shellfishing, Primary Contact, Secondary Contact,* and *Aesthetics.*

Sources of information include: DWM 1999 Survey data (Appendices A-C); the MA DEP DWM Toxicity Testing Database "TOXTD" (Dallaire 2000) Stream Team reports; NepRWA (NepRWA 1998, 1999, 2001a and b); MyRWA (MyRWA 2001); MWRA (Coughlin 2001a, 2001b, and 2002); USGS (Socolow et. al 1999, Socolow et. al. 2000). The MDPH Freshwater Fish Consumption Advisory List (MDPH 2001a) was used to assess the *Fish Consumption Use* and the DMF Shellfish Status Report was used to assess the *Shellfishing Use* (DFWELE 2000b). Where other sources of information were used to assess designated uses, citations are included.

[Note: Although the *Drinking Water Use* itself was not assessed in this water quality assessment report, the Class A waters were identified.]

SUMMARY

Use summary table (uses, status, causes and sources of impairment).

RECOMMENDATIONS

Additional monitoring and implementation needs.

MYSTIC RIVER SUBWATERSHED- RIVER AND ESTUARY SEGMENT ASSESSMENTS

Aberjona River (Segment MA71-01) 51
Alewife Brook (Segment MA71-04) 58
Malden River (Segment MA71-05) 63
Mystic River (Segment MA71-02) 66
Chelsea River (Segment MA71-06) 71
Mystic River (Segment MA71-03) 76

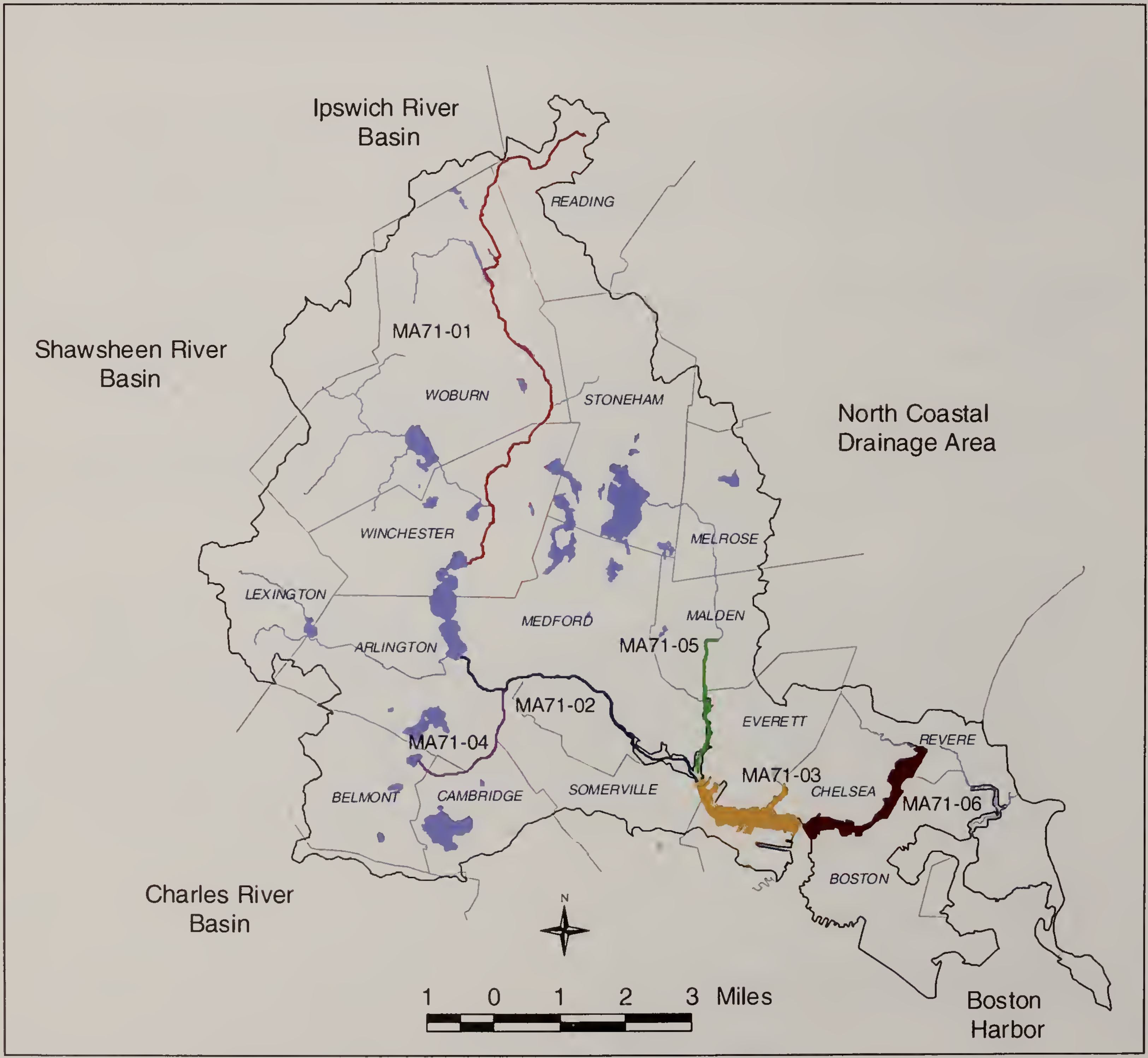


Figure 14. River/Estuarine Segments in the Mystic River Subwatershed

GENERAL ISSUES/RECOMMENDATIONS FOR THE MYSTIC RIVER SUBWATERSHED

Water quantity is an important issue throughout the Boston Harbor Watershed. The majority of public water, whether from local supplies or through the interbasin transfer of water from Quabbin Reservoir in central Massachusetts by the MWRA, is processed at the MWRA's Deer Island Wastewater Treatment Plant and discharged to Massachusetts Bay, bypassing local streams. Recharge of the local systems is mainly limited to precipitation events and low streamflow is a serious problem.

Above and beyond the water brought in from the Quabbin or water pumped from local aquifers, the sewer collection system drains an even larger amount of clean rain water and ground water from the Boston Harbor Watershed in the form of inflow and infiltration -- water which finds its way into the sewer system through cracks, poor joints, and illegal cross connections. Inflow and Infiltration (I/I) accounts for approximately 60% of overall sewer flow in the MWRA collection system, with some communities showing I/I rates of up to 75%. The overwhelming majority of the I/I problems are associated with municipal portions of the regional sewer system and not with the MWRA owned/operated lines. The municipal element includes both I/I in the 5,400+ miles of sewer lines owned/maintained by the municipality, and the 5,000+ miles of privately owned lateral connections. Infiltration is a major problem relative to groundwater loss. Inflow is most often associated with storm events and peak flows and tends to be a major cause of sanitary sewer overflows/backups. This loss of water essentially reduces available streamflow, and threatens instream uses such as aquatic life, habitat quality and quantity and recreational uses. A comprehensive regional I/I control program, involving the MWRA, municipal and privately owned sections of the sewer, should be developed to identify and remove sources of inflow and infiltration. A key component of the program is to develop a preventive and reactive operation, maintenance and rehabilitation program; without operation, maintenance and rehabilitation, sewer systems will continue to deteriorate and I/I will increase (Cooke and Lipman 2002).

Strong conservation measures through implementation strategies such as block rate pricing, installation of water-saving devices in homes and public buildings, and tying outdoor water use restrictions to streamflow levels, in concert with a strong educational program, will all help reduce the stress placed on the water resources throughout the Boston Harbor Watershed (Cooke and Lipman 2002).

Bacteriological contamination of waterbodies is a concern in the Mystic River Subwatershed and throughout the Boston Harbor Watershed. Pathogens may enter a waterbody as point or non-point source pollution. Point sources in the watershed are generally addressed under the National Pollutant Discharge Elimination System permitting program. Nonpoint source pollution can include urban runoff, faulty septic systems, and illegal/cross connections between the sewer and stormdrain systems. To improve water quality in the Mystic River Subwatershed, EPA / MA DEP sent letters to six communities (Arlington, Belmont, Cambridge, Somerville, Winchester and Medford), requesting information regarding dry weather discharges from storm water discharge pipes. Included in the information requested are maps of the location and size of the municipal storm water outfalls; maps of the location of any combined sewer/stormdrain manholes, sewer underdrains, and siphon structures; visual observations at all storm water discharge locations; outfall sampling from each discharge at least twice for fecal coliform bacteria and a plan to identify and eliminate illegal sewer discharges to stormdrains. The communities have responded to the letter and have taken action to identify and eliminate illegal discharges.

Under the Title 5 Program, the Commonwealth has developed three programs to assist homeowners with wastewater management problems. The Homeowner Septic Loan Program provides low interest loans to homeowners to upgrade systems that will not pass Title 5 inspections. The Comprehensive Community Septic Management Program provides betterment loans to communities to target known or suspected failures or to develop a community-wide management plan. The third option allows homeowners to claim tax credits for septic upgrades. Additional information about the Title 5 Program is available online from the MA DEP website http://www.state.ma.us/dep/brp/wwm/T5pubs.htm#add. In the Mystic River Subwatershed, the towns of Malden and Winchester have participated in the Comprehensive Community Septic Management Program (Chesebrough 2002).

The Boston Harbor Association with financial support of the Massachusetts Port Authority, the mayor's office, the City of Boston Environment Department, the Massachusetts Water Resources Authority, the

United States Environmental Protection Agency, the Massachusetts Environmental Trust, and the Massachusetts Office of Coastal Zone Management, initiated the Boston Harbor Marine Debris Salvage Program to clean up the waterfront and inner tributaries of Boston Harbor. This project has led to efforts to curtail the entrance of debris from the shore to the harbor. The Boston Conservation Commission and MA DEP have developed certain conditions to keep waterfront construction debris from entering Boston Harbor. Numerous cleanup projects along the Charles River, the Mystic River, and harbor beaches have also resulted (East Boston 21 August 2000).

Environmental Monitoring for Public Access and Community Tracking (EMPACT) is an EPA program created in 1996 to help communities collect and disseminate environmental data in almost real-time. The Town of Somerville has received an EPA grant in the amount of $363,257 to fund the installation of three monitoring sites along the Mystic River, and one site on Alewife Brook. The Mystic River, draining into Boston Harbor, has been plagued with chemical, nutrient, and hydrocarbon inputs, as well as pathogens and road salt from storm water runoff. The installation, and operation, of these sites will be conducted by the Mystic Watershed Collaborative (a partnership between the Mystic River Watershed Association (MyRWA) and Tufts University). The Collaborative will monitor fecal coliform bacteria, dissolved oxygen, conductivity, pH, and water depth at least five times per week. These data will be combined with meteorological information and presented in almost real-time in a web-based format. It is hoped that this data will spur public concern and action to remediate the Mystic River Subwatershed (EPA 2001c).

RECOMMENDATIONS

- Work with the MyRWA and the Executive Office of Environmental Affairs (EOEA) Mystic River Watershed Team to identify dry weather sources of bacteria in the Mystic River Subwatershed (e.g., nonpoint source pollution, wildfowl).
- Track progress of illegal connection identification and removal programs.
- Track progress of storm water management plans and implementation of best management practices.
- Determine the status of the septic system repairs being implanted under the Title 5 program in Malden and Winchester.
- Work with local citizens, watershed associations, and the EOEA Team to remove/reduce the trash and debris through the Mystic River Subwatershed
- Track progress of sewer separation projects and conduct monitoring to determine the effectiveness of these projects.
- Track progress of CSO abatement projects and conduct monitoring to determine the effectiveness of these projects.

ABERJONA RIVER (SEGMENT MA71-01)

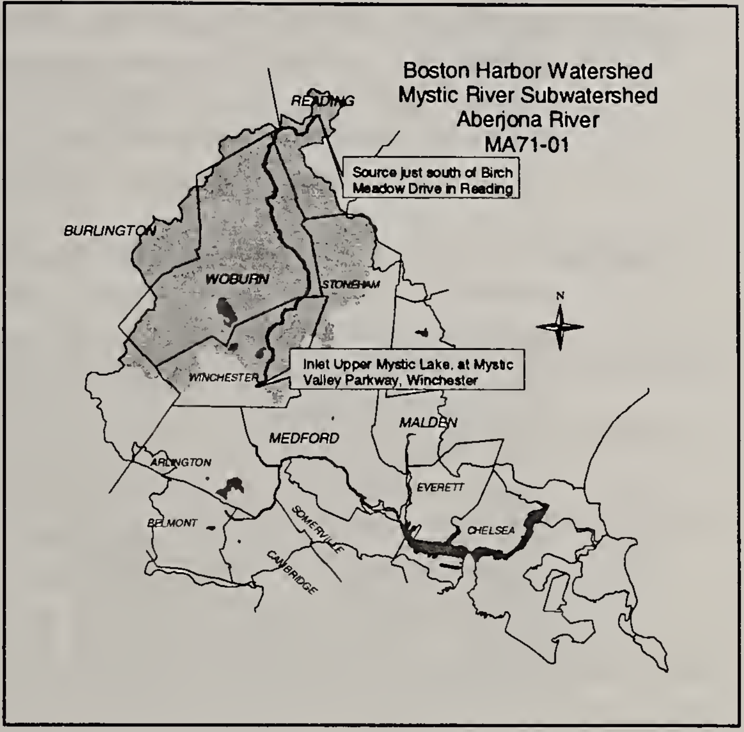
Location: Source just south of Birch Meadow Drive in Reading to inlet Upper Mystic Lake, at Mystic Valley Parkway, Winchester.
Segment Area: 9.2 miles.
Classification: Class B, Warm Water Fishery, CSO.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	49%
Forest	17%
Industrial	11%

This segment is on the 1998 303(d) list of impaired waters, needing confirmation, for unionized ammonia, organic enrichment/ low DO, and pathogens (MA DEP 1999a).

The Upper Mystic Lake Dam is at the end of this segment of the Aberjona River. The dam is maintained by MDC with no provisions for fish passage thereby limiting the spawning habitat/migration of anadromous fish (Chase 1996).



The Woburn landfill is located along this segment. (Additional information on landfills can be found in Appendix F).

The use assessments for Horn, Winter, Wedge, Judkins, and Mill ponds are provided in the Lakes section of this assessment report (Table 5).

USGS collected sediment and pumpkinseed (*Lepomis gibbosus*) samples from the Aberjona River at Winchester (below Waterfield Rd.) in September 1999 and again in August 2000 as part of their Toxics Substances Hydrology Program (an extension of the National Mercury Pilot Study), Urban Land Use Gradient Study (part of the NAWQA program) and the MA DEP Merrimack Valley Fish Study. The sediment was analyzed for total and methyl mercury, trace elements and organic compounds (Chalmers 2001). A five fish fillet composite pumpkinseed sample was analyzed for total mercury. The data from these analyses are not yet available (Chalmers 2001).

USGS Volatile Organic Compound (VOC) National Synthesis Team is attempting to assess atmospheric sources of VOC's to urban streams. Twenty-three surface water samples were collected between 1999 and 2000 from the Aberjona River at Winchester and analyzed for 85 VOCs. Concentrations of 78 of the VOCs were either below the Minimum Detection Limit (MDL), or their concentrations were estimated (Campo 2002). The remaining 7 VOCs, which were above the MDL, were all below the EPA Maximum Contaminant Level. No water quality standards have been accepted for these VOCs and, at present, only guidelines exist for the allowable concentrations that will be protective of aquatic life and human health. Additional atmospheric VOC samples, surface water VOC samples, and precipitation samples were collected in 2001 (Campo 2002).

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001a):

> The Industri-Plex site is a 245-acre industrial park that from 1853 to 1931 was used for manufacturing chemicals (e.g., lead-arsenic insecticides, acetic acid, and sulfuric acid) for local textile, leather, and paper manufacturing industries. Chemicals manufactured by other industries at the site include phenol, benzene, and toluene. From 1934 to 1969, the site was used to manufacture glue from raw animal hide and chrome-tanned hide wastes. The by-products and residues from these industries caused the soils within the site to become contaminated with elevated levels of metals, such as arsenic, lead and chrome. From 1969 to 1980, the site was developed for industrial use. Excavation in the 1970's uncovered and mixed industrial by-products and wastes accumulated over 130 years. During this period, residues from animal hide

> wastes used in the manufacture of glue were relocated on-site from buried pits to piles near swampy areas on the property. Many of the animal hide piles and lagoons on-site were leaching toxic metals into the environment. In the 1980's, the site contained streams and ponds, a warehouse and office buildings, remnant manufacturing buildings, and hide waste deposits buried on the site. Animal hide residues are found on approximately 20 acres of the site in four different piles. Portions of the animal hide piles sloughed off, causing the release of hydrogen sulfide gases to the atmosphere and toxic metals to surrounding wetlands. Residences are located within 1,000 feet of the site, and more than 34,000 people live within three miles of the site.

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001b):

> Wells G & H were two municipal wells developed in 1964 and 1967 to supplement the water supply of the City of Woburn. The wells supplied 30 percent of the city's drinking water. In 1979, city police discovered several 55-gallon drums of industrial waste abandoned on a vacant lot near the wells; subsequently these drums were removed. As a result of this discovery, the nearby wells were tested and found to be contaminated. Both of the wells were shut down in 1979 and a supplemental water supply arranged for the city. Five separate properties on the site were found to be the contributing sources of contamination to the aquifer that supplied the water to these two municipal wells. The total Superfund site covers an area of 330 acres. The site includes commercial and industrial parks, as well as recreational areas and some residential gardens. The Aberjona River flows through the middle of the site. Surface water runoff from the site is directed through drainage systems toward the river and its tributaries.

The EPA is conducting an investigation of the potential risk to human health and the environment in the Aberjona River from the Wells G&H Superfund Site to the Mystic Lakes. The investigation includes the collection of surface water and sediment samples, and the preparation of a baseline risk assessment. EPA anticipates completing the human health portion of the baseline risk assessment in Summer 2001. EPA has evaluated preliminary surface water and sediment data collected from the Wells G&H Operable Unit 3 (OU-3), Aberjona River Study. The preliminary data indicates that the primary contaminants of concern in the surface water and sediments are metals. The Industri-Plex Superfund Site is located immediately upstream of the Wells G&H Superfund Site and is connected to the site via the Halls Brook Holding Area (HBHA) and Aberjona River surface water flow. Based upon the preliminary data from the Wells G&H Site, EPA has decided to merge these portions of the river into one comprehensive Multiple Source Groundwater Response Plan (MSGRP) comprehensive Remedial Investigation/Feasibility Study (RI/FS) because they have similar contaminants of concern and fate and transport mechanisms, and it is reasonable and efficient to manage and evaluate potential cleanup alternatives for the river as a whole system. The MSGRP RI/FS will collect additional environmental samples from the river to fill in any significant data gaps within the Wells G&H OU-3, Aberjona River Study, and the Industri-Plex OU-1, Groundwater and Surface Water Response Plan (GSIP), as necessary. The implementation of the MSGRP RI/FS environmental sampling program began in July 2000, and will continue through Spring 2002 (EPA 2001b).

Work to be conducted as part of the MSGRP RI/FS environmental sampling program along the Aberjona River from the Industri-Plex site downstream to Route 128 is summarized below (Mayor 2001):

> Surface Water Monitoring Work: Regularly monitor surface water quality as it leaves the Halls Brook Holding Area pond and the downstream wetlands to establish baseflow conditions. Samples were collected from where Hall Brook Holding Area pond empties into the outlet channel, and where the HBHA outlet channel crosses under Mishawum Road. Samples were collected monthly for one year. Analytes included: toluene, benzene, arsenic (total and dissolved), chromium (total and dissolved), mercury (total), iron (total), and geochemistry parameters.
>
> Toxicological Work (May and June, 1999): Collect and analyze surface water, fish, sediment, benthic invertebrates, and vegetation samples, and evaluate ecological habitats and sediment biotoxicity studies. Each area was analyzed for the following:

- Sediment (13 locations)--chemical, physical, and toxicity [VOCs, SVOCs, pesticides, PCBs, total metals, acid volatile sulfide/simultaneously extractable metals, TOC, grain size, and biotoxicity testing]
- Surface water (15 locations)--chemical [VOCs, SVOCs, Pesticides, PCBs, total metals, dissolved metals, TSS, TOC, temperature, pH, conductivity, DO, and turbidity]
- Fish tissue--chemical [total metals and arsenic organic/inorganic speciation]
- Fish--external observation for abnormalities
- Benthic invertebrate tissue--chemical [PAHs and total metals]
- Benthic invertebrates (13 locations)--community structure
- Vegetation--chemical [total metals]

Downgradient Transport: Determine the hydraulic characteristics of the Halls Brook Holding Area Pond and wetlands over a range of discharge scenarios, identify sediment physical characteristics, quantify sediment loading, retention and export budgets for Halls Brook Holding Area under normal and high-flow. Samples were analyzed for the following:

- Depth-integrated sampling (nine locations) -- flow-weighted composite samples for three seasons, three sampling events per season, and nine sampling locations [TSS, total arsenic, dissolved arsenic, total chromium, total lead, total mercury, Bis(2ethylhexyl) phthalate, diethylypthalate, PAHs, 4-Methyl-2-pentanone, and 4-Methylphenol].
- Halls Brook Holding Area Pond discharge, and wetland discharge: at each location flow-weighted composite samples for 3 seasons, 3 events per season [Target Compound List VOCs, Target Compound List SVOCs, and Target Analyte List metals].

WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground S=surface	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Winchester Water Department	3344000		31934402	01S North Reservoir	1.06*	1.17
Woburn Water Department	3347000		31934703	01-10 G	4.07*	3.11
Kraft General Foods			31934704	Wells 1,2,5,6,7	1.0	0.75
Parkview Condominiums		9P231934403		NA	0.36	0.36**
Winchester Country Club		9P31934402		Irrigation Well Irrigation Pond	0.16 (180 days)	Well Never installed

*System-wide withdrawal **Parkview Condos newly issued permit on 6/30/2000 - 1999 average withdrawal is estimated from WMA permit application.

NPDES SURFACE DISCHARGE SUMMARY:

Olin Chemical, Wilmington (MA0005304) is permitted (issued 2000) to discharge 0.043 MGD treated wastewater from groundwater remediation activities to Halls Brook, a tributary to the Aberjona River. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ and a CNOEC $\geq 100\%$.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DWM conducted a benthic macroinvertebrate survey at one station on this segment: AR01—Aberjona River at the USGS gaging station in Winchester (Appendix C). The benthic community at AR01 received the lowest total metric score of the 14 biomonitoring stations surveyed in the Boston Harbor watershed survey, representing only 47% comparability to reference conditions (moderately impacted). Filter-feeding Hydropsychidae were hyperdominant, comprising over 60% of the sample. The abundance of filter-feeding organisms, along with gathering collectors such as the oligochaete worms and gammarid amphipods, implies that suspended and deposited forms of organic matter are the primary food resources in this portion of the river.

USGS conducted biomonitoring on the Aberjona River at Winchester (150 m reach downstream from gage) as part of the NAWQA NECB study during 1999, 2000, and 2001. Their sampling included reach delineation, fish community assessment, macroinvertebrate/algal sample collection and analysis, and habitat assessment. The data from the macroinvertebrate samples are currently being analyzed. Fish species collected included American eel (*Anguilla rostrata)*, bluegill (*Leopomis macrochirus*), brown bullhead (*Ameriurus nebulosus*), largemouth bass (*Micropterus salmoides*), pumpkinseed (L*epomis gibbosus*), white sucker (*Catastomus commersoni*), yellow perch (*Perca flavescens*), golden shiner (*Notemigonus crysoleucas*), and green sunfish (*Lepomis cyanellus*) (Beaulieau 2001). The assemblage is comprised mostly of macrohabitat generalists and may be considered pond species (Maietta 2001). However, one fluvial dependant (white sucker), a species that requires flowing water for some aspect of its life history, was collected in all three years.

The Mystic River Watershed Association (MyRWA) collected and analyzed benthic macroinvertebrate samples at two stations (ABR028- Aberjona River at Washington Street and ABR006- Aberjona River at USGS gaging station) on 4 and 18 November 2000 along this segment of the Aberjona River. At the upstream station (ARB0028), the sample was comprised of amphipods, oligochaetes, chrionomids, and hydropsychids. These results indicated a moderately impacted community on 4 November and a severely impacted benthic macroinvertebrate community on 18 November (MyRWA 2001). As part of their sampling in 2001, MyRWA will perform habitat assessments at both sites. The majority of organisms collected by MyRWA at the downstream station were hydropshchids, a very pollution tolerant taxon. Based on metric scores and guidelines from New York State, MyRWA concluded that site ARB006 was severely impacted on 4 November and slightly impacted on 18 November (MyRWA 2001).

Habitat/Flow

During the July 1999 macroinvertebrate survey, DWM noted sediment deposition throughout the reach. Filamentous green algae covered approximately 10% of the reach and were restricted to the rocky substrates in the riffle areas (Appendix C).

The Aberjona River is defined in the Massachusetts Stream and River Identification System (SARIS) as interrupted. Between Atlantic Avenue and Constitution Way the river is culverted and channeled underground thereby eliminating natural habitat for aquatic life.

The USGS NAWQA program collected flow data from their gage on the Aberjona River in Winchester. In 1999 the discharge ranged from 2.0 to 197 cfs. During the months of June, July, and August the flow was less than 10 cfs. The average flow for the month of June was 4.58 cfs. For July, the average discharge was 7.11 cfs and for the month of August, the average flow was 3.99 cfs. In 2000 the discharge ranged from 4.6 to 312 cfs. Discharges in July and September were mostly below 10 cfs, which is approximately half the annual average flow (Socolow *et al.* 1999 and Socolow *et al.* 2000).

Additionally, as part of the Massachusetts Watershed Initiative 99-02 grant project, flow data were collected by USGS at two sites on the Aberjona River on ten occasions between May 1999 and June

2000. Discharges at Salem Street in 1999 ranged from 0.95 to 3.3 cfs and in 2000 ranged from 4.4 to 89 cfs. Discharges at Washington Street ranged from 0.43 to 6.0 cfs in 1999 and from 7.6 to 196 cfs in 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001). It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

Toxicity

Effluent

Between February 1996 and April 2001, Olin Chemical conducted 20 whole effluent toxicity tests using *Ceriodaphnia dubia* and 17 whole effluent toxicity tests using *Pimephales promelas*. No acute whole effluent toxicity was detected (LC_{50}'s >100%). Of the 20 *C. dubia* tests, three were below the CNOEC limit of 100%: August 1998 = 50%, February 2001 = 25%, and April 2001 = 50%. Of the 17 *P. promelas* tests, only one was below the CNOEC limit of 100%: August 1998 = 50%. Olin Chemical discharges to Halls Brook, a tributary to the Aberjona River.

Chemistry – water

MyRWA collected water quality data at three sites on the Aberjona River: Salem Street, Woburn; Washington Street, Woburn; and the USGS gage in Winchester. Monthly samples for dissolved oxygen, conductivity, pH, temperature, total suspended solids, nitrate, and nitrite were collected between July and December 2000 and in May 2001 (MyRWA 2001).

USGS also collected water quality samples at Washington Street (01102474) and Salem Street (01102460) as part of the Massachusetts Watershed Initiative 99-02 grant. Dissolved oxygen, temperature, pH, ammonia-nitrogen, and total phosphorus samples were collected during May, June, July, September, and November 1999 and January, March, May and June 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001). Additionally, the USGS NECB- NAWQA program collected water quality data (pH, temperature, dissolved oxygen, ammonia -N, and phosphorus) from their gage (#01102500) at Winchester from October 1998 to September 1999 (Socolow *et al.* 1999 and Socolow *et al.* 2000).

DO

Dissolved oxygen concentrations were low at the Salem Street station as recorded by both MyRWA and USGS. DO concentrations measured by MyRWA ranged between 3.4 and 10.0 mg/L with three out of seven measurements below 5.0 mg/L (43%). USGS DO concentrations (n=10) ranged from 3.0 to 8.9 mg/L with one measurement below 5.0 mg/L.

Downstream at Washington Street, MyRWA dissolved oxygen concentrations ranged between 6.4 and 13.2 mg/L. DO at this station recorded by USGS ranged from 4.3 to 10.9 mg/L with three out of ten measurements below 5.0 mg/L.

At the downstream end of this segment at USGS gage #01102500 MyRWA recorded DO from 5.6 to 11.4 mg/L (n=7). USGS recorded dissolved oxygen levels from 3.0 to 12.8 mg/L in 1999. Half of the USGS weekly measurements during June, July, and August were below 5.0 mg/L. During 2000, however, DO levels ranged from 5.5 to 14.5 mg/L. In both years, a total of 11 out of 74 measurements were below 5.0 mg/L (15%).

No samples were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

Temperature readings did not exceed 28.3°C in any of the measurements collected in 1999 and 2000.

pH

MyRWA and USGS reported pH levels within the SWQS for a Class B, warm water fishery.

Total Suspended Solids (TSS)

TSS concentrations collected by MyRWA at their three stations ranged between below detection limit (BDL) and 10.5 mg/L (n=21).

Ammonia-Nitrogen (as N)

USGS ammonia-nitrogen concentrations ranged between BDL and 6.18 mg/L (1.9 times the Criterion Continuous Concentration or CCC). Eleven of the 96 samples were above the CCC.

Total Phosphorus (as P)

MyRWA total phosphorus concentrations (n=17) ranged between BDL and 0.15 mg/L with one greater than 0.1 mg/L.

During the NECB-NAWQA survey, total phosphorus concentrations ranged from 0.012 to 0.197 mg/L (n=53) with two greater than 0.1 mg/L. Total phosphorus levels collected as part of the MWI project were less than 0.070 mg/L at both stations (n=21).

No data/information were available to assess the upper 2.6 miles of the Aberjona River (not assessed). From the Industri-plex Site downstream, based on a loss of habitat, an impaired benthic macroinvertebrate community, low dissolved oxygen concentrations, and elevated nutrients the *Aquatic Life Use* is assessed as non-support (6.6 miles).

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

The MyRWA collected fecal coliform bacteria samples at two sites on the Aberjona River, Salem Street and Washington Street (dry weather conditions) in 2000 and 2001. At Salem Street, fecal coliform counts ranged between 30 and 2,700 cfu/100 mL (n=7). On three occasions levels were above 400 cfu/100mL (43%). Fecal coliform levels ranged between 100 and 1,050 cfu/100mL at Washington Street (n=7). Bacteria counts were above 400 cfu/100mL on three occasions (43%).

No data/information were available to assess the recreational uses for the upper 2.6 miles of the Aberjona River (not assessed). Based on elevated fecal coliform bacteria counts during dry weather conditions, the *Primary Contact Recreational Use* is assessed as non-support from the Industri-plex Site to the inlet of Upper Mystic Lake (6.6 miles). The *Secondary Contact Recreational Use*, however, is assessed as support (6.6 miles) since no counts were above 4,000 cfu/100mL.

AESTHETICS

During the July 1999 benthic macroinvertebrate survey, DWM identified moderate levels of instream turbidity (Appendix C). Although a narrow riparian buffer was noted, no obvious signs of objectionable deposits, odors or colors were recorded.

No data/information were available to assess the upper 2.6 miles of the Aberjona River (not assessed). Based on the overall high aesthetic quality of the lower 6.6 miles of the Aberjona River, the *Aesthetics Use* is assessed as support.

Aberjona River (MA71-01) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED upper 2.6 miles NON SUPPORT lower 6.6 miles	Organic enrichment/low DO, other habitat alterations, Unknown		Hydromodification and unknown	Urban runoff/storm sewers
Fish Consumption		NOT ASSESSED				
Primary Contact		NOT ASSESSED upper 2.6 miles NON SUPPORT lower 6.6 miles	Pathogens		Unknown	Illicit sewer connections, wildfowl
Secondary Contact		NOT ASSESSED upper 2.6 miles SUPPORT lower 6.6 miles				
Aesthetics		NOT ASSESSED upper 2.6 miles SUPPORT lower 6.6 miles				

RECOMMENDATIONS ABERJONA RIVER (MA71-01)

- The Olin Chemical Corp (MA0005304) should collect water from Halls Brook upstream of their discharge to use as dilution water in their whole effluent toxicity tests. If the Brook water does not meet the control test acceptability criteria (e.g., survival > 80% at 7-day), then Halls Brook water must still be utilized as a test control and not as a diluent.

- When available review the USGS sediment and fish data collected as part of their Toxics Substances Hydrology Program, Urban Land Use Gradient Study, and the MA DEP Merrimack Valley Fish Study to further assess potential impacts to aquatic life in the Aberjona River.

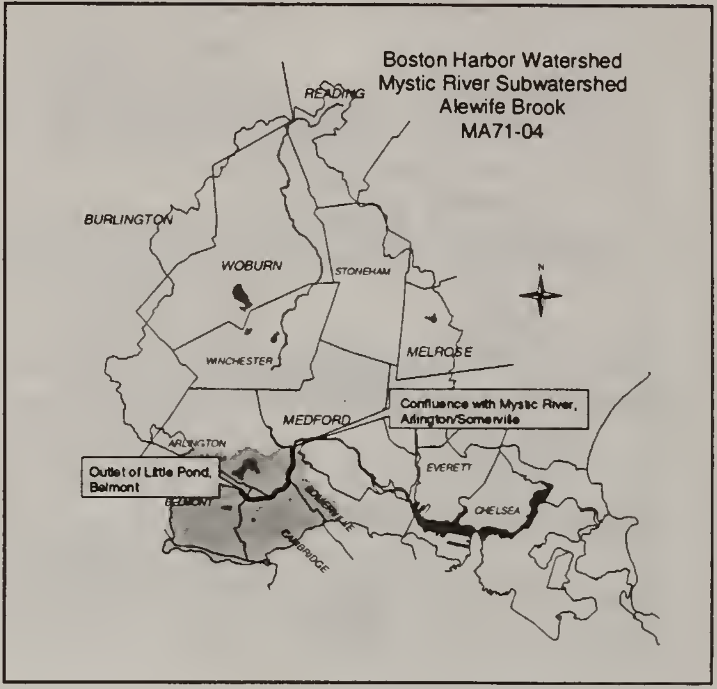
- When available review the USGS macroinvertebrate/algal sample collection and habitat assessment data from the Aberjona River at Winchester (150 m reach downstream from gage) collected as part of the NAWQA NECB study to further assess potential impacts to aquatic life in the Aberjona River.

- When available, review the data collected as part of the EPA MSGRP RI/FS environmental sampling program along the Aberjona River to further assess potential impacts to aquatic life in the Aberjona River.

- Work with the MyRWA and the EOEA Team to identify and eliminate dry weather sources of bacteria in the Aberjona subwatershed (e.g., nonpoint source pollution, waterfowl).

ALEWIFE BROOK (SEGMENT MA71-04)

Location: Outlet of Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville
Segment Area: 2.25 miles.
Classification: Class B Warm Water Fishery*.
(*In the 2002 updated SWQS Alewife Brook will be reclassified as Class B, CSO Variance. See Classification section.)



In future assessment reports, Alewife Brook (MA71-04) will be divided into two segments: Little River (MA71-07) from the outlet of Little Pond to the confluence with a small unnamed tributary near the Cambridge/Arlington town line and Alewife Brook (MA71-08) from the confluence with the Little River, Cambridge/Arlington to the confluence with the Mystic River, Arlington/Somerville.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	61%
Open Land	11%
Commercial	11%

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a)

The use assessments for Spy, Hill, and Clay Pit ponds and Blacks Nook are provided in the Lakes section of this assessment report (Table 5). The Amelia Earhart Dam controls the water level in Upper Mystic River and Alewife Brook.

WMA WATER WITHDRAWAL SUMMARY:
There are no regulated water withdrawals from the Alewife Brook subwatershed.

NPDES SURFACE DISCHARGE SUMMARY:
Massachusetts Water Resources Authority Deer Island WWTP (MA0103284) is permitted (issued 2001) to discharge up to 1,270 MGD treated wastewater to Massachusetts Bay via outfall 001 and combined sewage via CSO's 003, 201, 203, 205, 010, 018, 019, 020, 021, 022, 023, 205A, 207, 209, 211 to Alewife Brook, Inner Harbor, Mystic River, Charles River, and Dorchester Bay. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$. The facility's TRC limit is 631 µg/L (maximum daily).

The City of Somerville (MA01101982) was permitted to discharge combined sewage via six CSOs to Alewife Brook. The permit expired 29 September 1997. Somerville has eliminated 5 of the 6 CSO outfalls and now only has a single permitted CSO outfall, SOM 001A. The NPDES Permit is expected to be reissued in 2002.

The City of Cambridge (MA0101974) is permitted to discharge via seven CSOs to Alewife Brook. The permit expired 25 April 1998. The permit is expected to be reissued in 2002.

On 5 March 1999, a CSO Variance was issued by the MA DEP for the CSO discharges to the Alewife Brook/Upper Mystic River watershed. The Conditions of the Variance require MWRA to move forward with CSO projects determined to be feasible and cost-effective in the CSO Facilities Plan, and also gather more information on CSO and storm water loads in the watershed. The CSO projects slated to move forward included sewer separation work in Cambridge to substantially mitigate CSO discharges to Alewife Brook. During detailed design for these facilities, the City determined that the combined sewer system was much more extensive than previously documented, and in fact discovered an additional, unpermitted CSO outfall. Subsequently, after environmental review, MWRA and the City of Cambridge have revised and expanded the sewer separation program to a $ 74 million program to address the more extensive

CSO discharges and to prioritize protection of the City of Cambridge drinking water reservoir, Fresh Pond. The City of Cambridge is now proceeding with the permitting phase of the project (Brander 2001b).

Work completed to date has resulted in the closure of six of the 14 CSO outfalls in the Alewife/Upper Mystic watershed. The sewer separation work noted above, along with the hydraulic relief projects and floatables control facilities, which are now moving forward, are expected to substantially mitigate existing untreated CSO discharge by reducing the volumes by 84% and limiting annual activations to less than seven events per year on average. Floatables controls will be provided for all active CSO outfalls (Brander 2001b).

Based on the progress of the CSO abatement work, and the additional water quality and technical information gathered, MWRA will develop a Final CSO Assessment Report during the Variance timeframe. This Report will be subject to public environmental review, and EPA and MA DEP will determine at that time if higher levels of CSO control are required pursuant to the federal and state regulations (Brander 2001b).

Consistent with the 1997 Final CSO Facilities Plan, MWRA will be required to periodically reassess, optimize, and enhance its CSO Control Plan based upon new or updated information as may be received during future CSO implementation activities during the Project design phase. In general, any proposed revision that would result in a substantive increase in the number of CSO activations and/or result in a significant increase in the volume of CSO discharge would require a formal public review and comment process, and subsequent revision(s) to the NPDES Permit and/or Court Order (Brander 2001b).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

Dry weather sampling programs have identified many storm drains in this segment that appear to be conveying wastewater flows. MA DEP has issued Notices of Noncompliance (NONs) to communities in the Alewife/Mystic watershed requiring them to move forward with programs to identify and remove illegal connections to storm drains. While initial phases of the work are underway, further work is needed to eliminate these pollution sources (Brander 2002).

USE ASSESSMENT

AQUATIC LIFE

Habitat/Flow

> As part of the Massachusetts Watershed Initiative 99-02 grant project, flow data was collected by USGS at one site on Alewife Brook on ten occasions between May 1999 and June 2000. Discharges in 1999 ranged from 1.4 cfs to 5.9 cfs and in 2000 ranged from 5.4 cfs to 45 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001).

Chemistry - water

The MyRWA collected water quality data at one site on Alewife Brook (ALB006, Broadway Arlington/Somerville). Monthly samples for dissolved oxygen, pH, temperature, and total suspended solids were collected between July and December 2000, and May 2001 (MyRWA 2001).

As part of the MWI 99-02 grant, USGS sampled Alewife Brook at the same location as MyRWA on ten occasions between May 1999 and June 2000. Parameters measured included dissolved oxygen, temperature, ammonia-nitrogen (as N), and total phosphorus (Socolow *et al.* 2000 and Socolow *et al. 2001*).

The Alewife/Mystic River Advocates collected wet and dry weather water quality samples at five stations along Alewife Brook: SOM 001-Woodstock St, Broadway-Broadway Bridge, SOM 002-Powder House Blvd., SOM 003-Powder House Blvd., and SOM 004-Gordon St. Between November 1999 and November 2000, as part of a 319 grant with the City of Somerville, they also collected pH, temperature, and dissolved oxygen data (DFWELE 2001a).

The Massachusetts Water Resource Authority (MWRA) collected water quality samples at four stations on Alewife Brook between 1996 and 2000 as part of their ongoing CSO monitoring program (Coughlin 2002):

070- Alewife Brook off Mystic Valley Parkway B
074- Alewife Brook offramp to Alewife T
174- Alewife Brook (Little River) 415 ft upstream of Route 2E Offramp to Alewife T
172- Alewife Brook upstream side of Mass. Ave. Bridge, mid channel

Samples were analyzed for DO, % saturation, temperature, and turbidity.

DO

Dissolved oxygen concentrations reported by Alewife/Mystic River Advocates fell below 5.0 mg/L in nine of the 49 samples collected. These low concentrations were recorded in the summer (June, July and August) of 2000. Thirteen of the percent saturations were below 60% (n=49).

Dissolved oxygen concentrations reported by MyRWA at Broadway ranged between 3.4 mg/L and 10 mg/L (n=7) with two samples below 5.0 mg/L. At the same station, DO concentrations reported by USGS ranged from 2.7 to 9.2 mg/L with 4 out of 11 measurements were less than 5.0 mg/L.

Dissolved oxygen concentrations reported by MWRA ranged between 1.77 and 11.36 mg/L with 76 less than 5.0 mg/L (n=244). Percent saturations ranged between 17 and 110.8% with 104 out of the 243 measurements less than 60%.

No samples were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

Temperature readings did not exceed 28.3°C in any of the measurements collected by MyRWA USGS, and MWRA (n>250).

pH

MyRWA and USGS reported pH levels within the SWQS for a Class B, warm water fishery (n=19).

Turbidity

Turbidity measurements recorded by MWRA ranged between 0 and 38.1NTU with an average of 5.53 NTU (n=145).

Suspended Solids

TSS concentrations collected by MyRWA ranged between 5.8 and 24 mg/L (n=7).

Ammonia-Nitrogen

In the USGS surveys, ammonia-nitrogen (as N) concentrations ranged from 0.123 to 0.724 mg/ L (n=12). All were below the acute and chronic water quality criterion for ammonia-nitrogen.

Total Phosphorus (as P)

MyRWA and USGS reported total phosphorus concentrations at Broadway ranged from 0.078 to 0.23 mg/L (n=19) with 15 greater than 0.1mg/L.

Chemistry – sediment

In 1999, eleven surface sediment samples were collected from Alewife Brook and analyzed using Instrumental Neutron Activation Analysis and Flame Atomic Absorption Spectroscopy for a suite of elemental contaminants as a part of a Tufts Masters thesis research (Ivushkina 1999). The results of this study are presented below. Sediment concentrations of both copper and lead were found to be above the severe effect level (S-EL) for aquatic life. Arsenic, cadmium, chromium, and zinc were all found to be above the lowest effect level (L-EL).

Element	Min	Max	Mean	n	L-EL (Persuad *et al.* 1993)	S-EL (Persuad *et al.* 1993)
As	8	38	20.84	11	6	33
Cd	0.4	3.3	1.16	11	0.6	10
Cr	56	150	92.55	11	26	110
Cu	57	290	139.4	10	16	110
Pb	170	1000	362	10	31	250
Zn	100	3100	649.09	11	120	820

The *Aquatic Life Use* for Alewife Brook is assessed as non-support due to low DO concentrations, low percent saturations, moderately high nutrients, and elevated levels of trace elements in the sediments.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of the MWI Grant 99-02, USGS sampled Alewife Brook at Broadway on three occasions (20 May, 17 June and 30 June 1999). Fecal coliform levels ranged from 900 cfu/100mL to 17,000 cfu/100 mL (Socolow *et al.* 2000 and Socolow *et al.* 2001).

The MyRWA collected fecal coliform bacteria samples (dry weather) also from Broadway on seven occasions between July and December 2000 and May 2001. Concentrations ranged from 260 to 38,900 cfu/100mL. Six of the seven samples were above 400 cfu/100mL, two were above 2,000 cfu/100mL and one was above 4,000 cfu/100mL (MyRWA 2001).

MWRA collected fecal coliform bacteria samples and Secchi disk depth readings at their four stations on Alewife Brook between 1996 and 2000 as part of their ongoing CSO monitoring program (Coughlin 2002). Fecal coliform bacteria counts ranged between 10 and 110,000 cfu/100mL (n=257). During the primary recreation season, fecal coliform bacteria counts ranged between 10 and 110,000 with 152 counts greater than 400cfu/100mL. Secchi disk depths (n=71) recorded by MWRA ranged between 0.2 and 9 m (at station 070 at the Mystic Valley Parkway bridge) and could be seen all the way to the bottom on 15 occasions.

It should be noted that this segment currently receives the flow from eight active untreated CSOs. MWRA and the cities of Cambridge and Somerville have completed sewer separation projects and are implementing hydraulic relief projects and floatables control facilities which are expected to substantially mitigate existing untreated CSO discharge by reducing the volumes by 84% and limiting annual activations to less than seven events per year on average (Brander 2001b).

Based on the elevated fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational* uses for Alewife Brook are assessed as non-support.

AESTHETICS

The Alewife/Mystic River Advocates and the Friends of the Mystic River conducted shoreline surveys of the Mystic River, Alewife Brook, and the Malden River during spring 1995 and fall 1996. Alewife Brook runs channelized and fenced for most of its length. The surveys indicated many discharge pipes (including CSOs), oily sheens, rotten egg odors, a concrete river channel, trash, and little aquatic/terrestrial life (AMRA 1997).

R. Frymire sampled (during dry and wet weather) pipes discharging to Alewife Brook and the Little River (within the cities of Cambridge, Somerville, Belmont, and Arlington) for the MyRWA. During dry weather conditions several pipes were discharging. Additionally, sewage odors, invasive aquatic plants (*Phragmites australis*), and oil sheens were noted (Frymire 2000).

The Alewife Brook/ Little River Stream Team conducted shoreline surveys of 21 reaches along Alewife Brook and Little River during June 2000. They noted “muddy” water, trash, erosion, invasive species.

(*Phragmites australis* and Japanese Knotweed), outfalls/pipes, sewage odor, and an oil spill along Alewife Brook. There is public access along the brook and much of the land surrounding the brook is owned by MDC (DFWELE 2000a).

Due to an overall degraded aesthetic quality (i.e., trash and debris, odors, and oily sheens) the *Aesthetics Use* is assessed as non-support

Alewife Brook (MA71-04) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NON-SUPPORT	Organic enrichment/low DO, nutrients, metals		Urban runoff/storm sewers, CSO	Illicit sewer connections
Fish Consumption	NOT ASSESSED				
Primary Contact	NON-SUPPORT	Pathogens		CSO	Illicit sewer connections
Secondary Contact	NON-SUPPORT	Pathogens		CSO	Illicit sewer connections
Aesthetics	NON-SUPPORT	Objectionable deposits, taste/odor, oil and grease		Urban runoff/storm sewers, CSO	

RECOMMENDATIONS ALEWIFE BROOK (MA71-04)

- Work with local citizens and stream teams to remove/reduce the trash and debris in Alewife Brook.
- Continue implementation of the $74 million MWRA CSO Abatement Plan in the Alewife/Mystic watershed.
- Work with MDC to develop water release practices at the Amelia Earhart Dam that will benefit the aquatic life of the Alewife/Mystic subwatershed.
- Work with the City of Cambridge to implement the Fresh Pond Reservoir Watershed Protection Plan and Stewardship.

MALDEN RIVER (SEGMENT MA71-05)

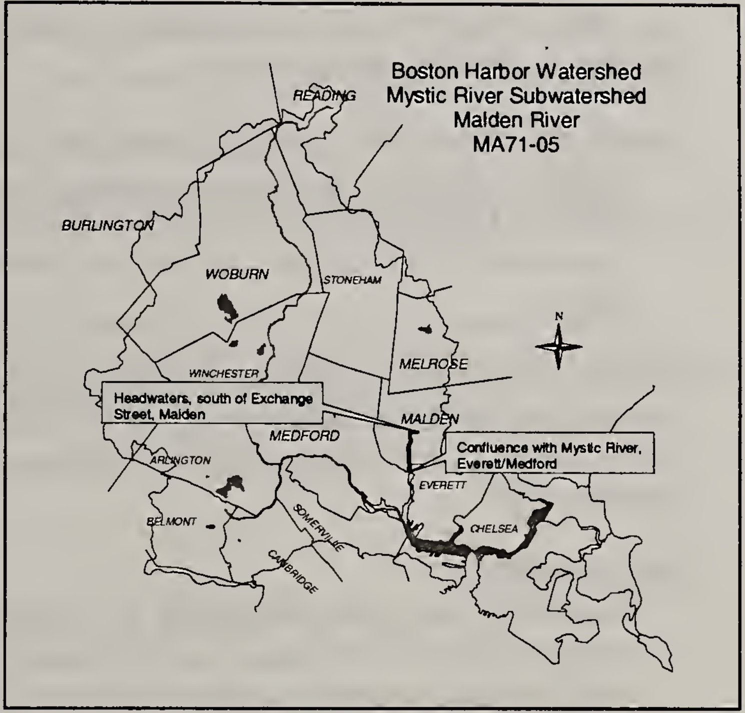
Location: Headwaters, south of Exchange Street, Malden to confluence with Mystic River, Everett/Medford.
Segment Area: 1.9 miles.
Classification: Class B Warm Water Fishery.

Land use estimates for this segment are unavailable.

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO, pathogens, and suspended solids (needs confirmation) (MA DEP 1999a). Included within the Malden River subwatershed is part of the Middlesex Fells Reservation. This MDC managed property is the largest open space in the Mystic River subwatershed (Perez 2002).

WATER WITHDRAWAL SUMMARY

There are no regulated water withdrawals from the Malden River.



NPDES SURFACE DISCHARGE SUMMARY:

Rohm Technology Inc (MA0031780); AVCO Everett Lab/Textron (MA0032301); Gateway Condominiums (MA0030759); Wellington Business Center (MA0030546); Imported Stone Inc. (MA0034622, expired 17 June 1993) are all listed on the 24 October 2000 EPA active facility list.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry - water

MyRWA collected water quality data at one site on Malden River—MAR036 at Medford Street. Monthly samples for dissolved oxygen, conductivity, pH, temperature, and total suspended solids were collected between July and December 2000, and in May 2001 (MyRWA 2001).

DO

Dissolved oxygen concentrations ranged between 5.3 and 10.6 mg/L (n=6). No samples were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=6)

pH

pH ranged from 6.9 SU to 8.9 SU (n=5) with one measurement above 8.5 SU.

Total Suspended Solids

TSS concentrations ranged between 2.5 and 8.2 mg/L (n=6).

Total Phosphorus (as P)

Total phosphorus concentrations ranged from BDL to 0.17 mg/L (n=5) with two samples greater than 0.1 mg/L.

Too little instream data (limited spatial coverage) are available to assess the *Aquatic Life Use*; therefore, this use is currently not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

MyRWA collected dry weather fecal coliform bacteria samples on seven occasions on the Malden River at Medford Street between July and December 2000 and May 2001. Bacteria counts ranged between <10 cfu/100mL and 940 cfu/100mL, with two counts greater than 400 cfu/100mL (MyRWA 2001).

Too little instream data (limited spatial coverage) are available to assess the *Primary and Secondary Contact Recreational* uses; therefore, it is currently not assessed. The Malden River, however, is on "Alert Status" due to slightly elevated bacteria counts during dry weather and the urban nature of this subwatershed.

AESTHETICS

Alewife/Mystic River Advocates and Friends of the Mystic River conducted shoreline surveys of the Malden River on 20 August and 23 October 1996. They noted overall instream conditions as poor; tires littered the entire length of the river; the water appeared cloudy and opaque in color; oil sheens and oil smells, and an abundance of trash were common. Sixteen storm water pipes were noted within the survey area. Water levels were very low and "although the water is seldom observed over three feet deep, the bottom is not visible" (AMRA 1997). Additionally, little to no formal public access exists.

Based on the evidence of trash and debris, oil sheens, and other aesthetic quality degradation, the *Aesthetics Use* is assessed as non-support for the entire length of the Malden River.

Malden River (MA71-05) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Primary Contact*	NOT ASSESSED*				
Secondary Contact*	NOT ASSESSED*				
Aesthetics	NON-SUPPORT	Objectionable deposits, oil & grease, and taste & odor		Urban runoff/storm sewers	

* "Alert Status" issues identified; see *Primary* and *Secondary Contact Recreational Use* assessment

RECOMMENDATIONS MALDEN RIVER (MA71-05)

- Work with local citizens and stream teams to remove/reduce the trash and debris in the Malden River.

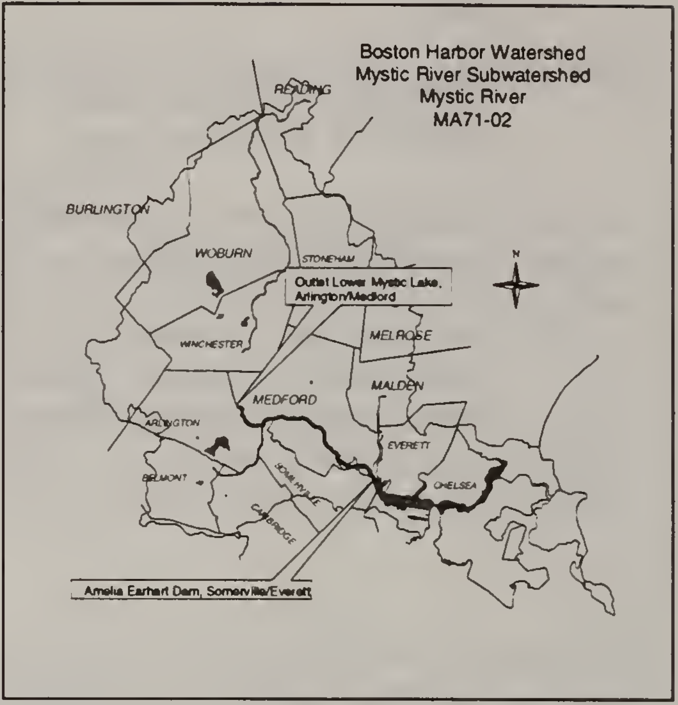
- Work with MyRWA and EOEA to increase water quality monitoring (i.e., spatial coverage) to assess the designated uses.

- Conduct biomonitoring and fish toxic monitoring to assess the Aquatic Life and Fish Consumption uses for the Malden River.

- Work with EPA to determine if Rohm Technology Inc (MA0031780), AVCO Everett Lab/Textron (MA0032301), Gateway Condominiums (MA0030759, Wellington Business Center (MA0030546), and Imported Stone Inc. (MA0034622) are still discharging to the Malden River.

MYSTIC RIVER (SEGMENT MA71-02)

Location: Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett.
Segment Area: 5.4 miles.
Classification: Class B, Warm Water Fishery, CSO.



Land use estimates for this segment are unavailable.

This segment is on the 1998 303(d) list of impaired waters for metals, nutrients, and pathogens (needs confirmation) (MA DEP 1999a).

"The privilege of taking fish was given in 1633-34 by the General Court to Governor Winthrop and Matthew Craddock at the weir 'at Mysticke' situated where High Street, Medford, now crosses the river". Provisions for passage and restrictions on fishing methods and locations were established in 1789. In 1966, the Amelia Earhart Dam, maintained by the MDC, was built to prevent salt water intrusion into the Lower Mystic Lake. The Mystic River anadromous fish run is currently managed under state regulations (Brady 2001).

Downstream from the confluence with Alewife Brook flow of the Mystic River is restricted by the remnants of the Craddock locks. Debris is restricting flow at the locks; however, MDC is currently working to alleviate this problem. Camp Dresser & McKee conducted a hydraulic study of the Craddock Locks for MDC and determined that removal of the locks would not be cost effective, as they support most of the Main Street bridge (Laramie 2002).

Included within the Malden River subwatershed is part of the Middlesex Fells Reservation. This MDC managed property is the largest open space in the Mystic River subwatershed (Perez 2002).

The use assessment for Bellevue Pond is provided in the Lakes section of this assessment report (Table 5).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground S=surface	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Winchester Water Department	3344000		31934402	02s middle reservoir 03s south reservoir	1.06*	1.17**

* System-wide withdrawal ** Exceeded WMA threshold of >0.1MGD over registration volume

NPDES SURFACE DISCHARGE SUMMARY:

The City of Somerville (MA01101982) is permitted to discharge via two CSOs to the Mystic River. The permit expired 29 September 1997. Somerville has since eliminated one CSO outfall and has only one remaining, SOM 007A, which discharges only treated CSO flows. Somerville's NPDES permit is expected to be reissued in 2002.

The City of Chelsea (MA0101877) is permitted to discharge via one CSO to the Mystic River. The permit expired 13 August 1998. The permit is expected to be reissued in 2002.

On 5 March 1999, a CSO Variance was issued by the MA DEP for the CSO discharges to the Alewife Brook/Upper Mystic River watershed. The Conditions of the Variance require MWRA to move forward with CSO projects determined to be feasible and cost-effective in the CSO Facilities Plan, and also gather more information on CSO and storm water loads in the watershed. The CSO projects slated to move forward included sewer separation work in Cambridge to substantially mitigate CSO discharges to Alewife Brook. During detailed design for these facilities, the City determined that the combined sewer system was much more extensive than previously documented, and in fact discovered an additional, unpermitted CSO outfall. Subsequently, after environmental review, MWRA and the City of Cambridge have revised and expanded the sewer separation program to a $74 million dollar program to address the more extensive CSO discharges and to prioritize protection of Fresh Pond, the City of Cambridge drinking water reservoir. The City of Cambridge is proceeding with the permitting phase of the project (Brander 2001b).

Work completed to date has resulted in the closure of six of the 14 CSO outfalls in the Alewife/Upper Mystic watershed. The sewer separation work noted above, along with the hydraulic relief projects and floatables control facilities, which are now moving forward, are expected to substantially mitigate existing untreated CSO discharge by reducing the volumes by 84% and limiting annual activations to less than seven events per year on average. Floatables controls will be provided for all active CSO outfalls (Brander 2001b). Additional work includes upgrades to the Somerville Marginal CSO Treatment Facility. This facility provides screening and disinfection of CSO flows prior to discharge at MWR 205, just downstream of the Amelia Earhart Dam. When tidal conditions prevent discharge from MWR 205, the treated CSO flow is discharged through SOM 007A in this segment upstream of the Dam.

Based on the progress of the CSO abatement work, and the additional water quality and technical information gathered, MWRA will develop a Final CSO Assessment Report during the Variance timeframe. This report will be subject to public environmental review, and EPA and MA DEP will determine at that time if higher levels of CSO control are required pursuant to the federal and state regulations (Brander 2001b).

Consistent with the 1997 Final CSO Facilities Plan, MWRA will be required to periodically reassess, optimize, and enhance its CSO Control Plan based upon new or updated information as may be received during future CSO implementation activities during the project design phase. In general, any proposed revision that would result in a substantive increase in the number of CSO activations and/or result in a significant increase in the volume of CSO discharge would require a formal public review and comment process, and subsequent revision(s) to the NPDES Permit and/or Court Order (Brander 2001b).

Dry weather sampling programs have identified many storm drains in this segment that appear to be conveying wastewater flows. MA DEP has issued Notices of Noncompliance to communities in the Alewife/Mystic watershed requiring them to move forward with programs to identify and remove illegal connections to storm drains. While initial phases of this work are underway, further work is needed to eliminate these pollution sources.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

The Mystic River presently supports a good population of Alewives and Blueback herring, which pass through the Amelia Earhart Dam and concentrate each spring at the dam apron between Upper and Lower Mystic Lakes. Provisions for passage and restrictions on fishing methods and locations were established in 1789. The Mystic River run is currently managed under state regulations. Anecdotal information indicates that the run is likely in a state of dynamic equilibrium and in the several hundred thousand individual range (Brady 2001).

Chemistry - water

MyRWA sampled water quality in the Mystic River at Route 60, near Lower Mystic Lake. Monthly samples for dissolved oxygen (DO), conductivity, pH, temperature, and total suspended solids (TSS) were collected between July and December 2000 and May 2001 (MyRWA 2001).

USGS sampled two sites on the Mystic River in 1999 and 2000 as part of the MWI 99-02 grant project. Dissolved oxygen, pH, temperature, ammonia-nitrogen, and total phosphorus samples were collected at gage 01103017 at Route 60 on five occasions in 1999 and on four occasions in 2000. Data were also collected on 30 December 1999 and 4 January and 21 June 2000 at gage 01103033 at Main Street, Medford (Socolow *et al.* 2000 and Socolow *et al.* 2001).

MWRA collected water quality samples at seven stations on this segment of the Mystic River between 1996 and 2000 (Coughlin 2002):

057- at Mystic/Alewife confluence
083- upstream of Mystic/Alewife confluence
066- at Boston Ave. bridge
056- 100m upstream of Route 93
067- Route 28 bridge
059- Mystic/Malden confluence
167- Amelia Earhart Dam upstream side.

Samples were analyzed for DO, % saturation, temperature, turbidity, and chlorophyll *a*.

DO

MyRWA dissolved oxygen concentrations recorded at Route 60 ranged from 7.1 to 10.6 mg/L (n=7) while USGS concentrations at this location ranged from 4.7 to 12.0 mg/L (n=9). Only one measurement was less than 5.0 mg/L. Dissolved oxygen levels at Main Street ranged from 7.9 to 11.3 mg/L (n=3).

MWRA DO concentrations from their seven stations ranged between 0.1 and 18.64 mg/L with only 63 out of 989 measurements less than 5.0 mg/L. Percent saturation ranged from 1.2 to 156.8% with 81 measurements less than 60% and 62 measurements greater than 115% (n=989). It should be noted that at Station 167, upstream of the Amelia Earhart Dam, dissolved oxygen concentrations in the bottom waters were consistently below 5.0 mg/L and 60% saturation during the summer months. Additional data is needed to determine if this is the result of salt-water seepage through the Amelia Earhart Dam and to determine if low dissolved oxygen concentrations during the summer months persist throughout the segment.

No samples were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature measurements collected by MyRWA, USGS, and MWRA were below the Class B SWQS (n>1,000).

pH

pH recorded by MyRWA and USGS ranged from 6.5 to 8.9 SU at Route 60 (n=16) with three above 8.3. At Main Street, USGS recorded pH measurements between 6.6 and 7.0 SU.

Turbidity

Turbidity measurements recorded by MWRA ranged between 0 and 42 NTU with an average of 5.19 NTU (n=639).

Total Suspended Solids

TSS levels collected by MyRWA at Route 60 ranged from BDL to 8.0 mg/L (n=7).

Chlorophyll a

Chlorophyll a concentrations reported by MWRA ranged between 1.84 and 131 µg/L (n=263).

Ammonia-Nitrogen (as N)

Ammonia-nitrogen concentrations recorded by USGS at Route 60 ranged from BDL to 0.663 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations measured by MyRWA and USGS at Route 60 ranged between BDL and 0.129 mg/L (n=16) with only one sample greater than 0.1 mg/L.

This segment of the Mystic River supports the *Aquatic Life Use* based on chemical water quality parameters within the SWQS for a Class B Warm Water Fishery. However, this segment is on 'Alert Status" due to slightly elevated nutrient concentrations (i.e., total phosphorus and chlorophyll a) and low dissolved oxygen concentrations in bottom waters during summer months.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

MyRWA collected seven dry weather fecal coliform bacteria samples at Route 60 (near outlet of Lower Mystic Lake) between July and December 2000 and May 2001. Bacteria counts ranged from <10 to 6400 cfu/100mL with one count greater than 400 cfu/100mL (MyRWA 2001). USGS also collected three fecal coliform bacteria samples at Route 60 as part of the MWI 99-02 grant project. Bacteria counts ranged from 20 to 70 cfu/100mL. (Socolow *et al.* 2000 and Socolow *et al.* 2001).

MWRA collected fecal coliform bacteria samples at seven stations as part of their ongoing CSO monitoring program between 1996 and 2000 (Coughlin 2002). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged between <5 and 30,400 cfu/100mL with only 38 samples greater than 2,000 cfu/100mL and 17 samples greater than 4,000cfu/100mL (n=732). During the primary contact season, fecal coliform bacteria counts ranged between <5 and 30,400cfu/100mL (n=543) with 107 greater than 400cfu/100mL (20%). Secchi disk depth readings recorded by MWRA ranged from 0 to 9m and could be seen all the way to the bottom on 68 occasions (n=548).

Additionally, this segment receives flow from one active CSO. MWRA and the cities of Cambridge and Somerville have completed sewer separation projects and are implementing hydraulic relief projects and floatables control facilities which are expected to substantially mitigate existing untreated CSO discharge by reducing the volumes by 84% and limiting annual activations to less than seven events per year on average (Brander 2001b).

Based on elevated fecal coliform bacteria counts during both wet and dry weather conditions, the *Primary* and *Secondary Contact Recreational uses* are assessed as partial support for this segment.

AESTHETICS

The Alewife/Mystic River Advocates and the Friends of the Mystic River conducted shoreline surveys of the Mystic River, Alewife Brook, and the Malden River during spring 1995 and fall 1996. The water from the outlet of Lower Mystic Lake to the Water Street Bridge appeared "fairly clear"; with limited trash and debris. Downstream from Main Street (lower 2.7 miles), a number of pipes were discharging in dry weather. In addition, oil sheens, trash and debris, and car tires and batteries were seen in the streambed (AMRA, 1997). MDC owned parkland surrounds much of the river. People actively frequent the banks of the river for recreational use.

Secchi disk depth readings recorded by MWRA ranged from 0 to 9 m and could be seen all the way to the bottom on 68 occasions (n=548).

The *Aesthetics Use* is assessed as support for the upper mile of the Mystic River due to good water clarity and high aesthetic quality. This use is not assessed downstream from Alewife Brook (lower 4.4

miles) due to the lack of current instream aesthetic quality observations (i.e., observations are greater than 5 years old).

Mystic River (MA71-02) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		SUPPORT*				
Fish Consumption		NOT ASSESSED				
Primary Contact		PARTIAL SUPPORT	Pathogens		CSO	Urban runoff/ storm sewers
Secondary Contact		PARTIAL SUPPORT	Pathogens		CSO	Urban runoff/ storm sewers
Aesthetics		SUPPORT upper 1.0 miles NOT ASSESSED lower 4.4 miles				

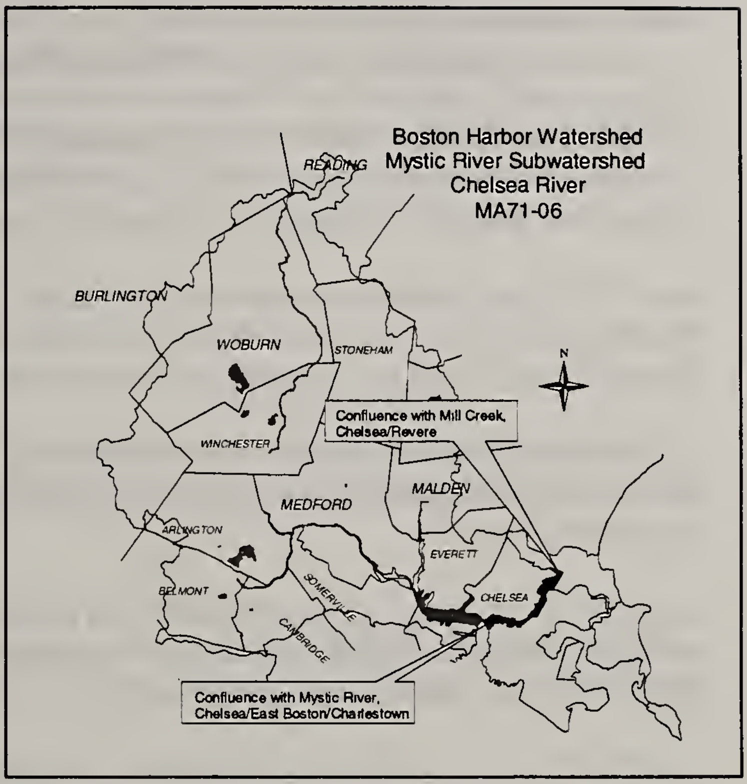
* "Alert Status" issues identified; see *Aquatic Life Use* assessment

RECOMMENDATIONS MYSTIC RIVER (MA71-02)

- Work with local citizens and stream teams (Alewife/Mystic River Advocates and the Friends of the Mystic River) to remove/reduce the trash and debris in the Malden River.
- Continue implementation of the $74 million MWRA CSO abatement program in the Alewife/Mystic watershed.
- Work with the MDC to determine to what extent salt water may be seeping through the Amelia Earhart Dam and determine if salt water intrusion may be contributing to low dissolved oxygen concentrations observed at MWRA sampling location 167.
- Work with the MWRA to collect bottom dissolved oxygen data during summer months from all of their sampling locations to determine if low dissolved oxygen levels in bottom waters are common throughout this segment of the Mystic River.

CHELSEA RIVER (SEGMENT MA71-06)

Location: Confluence with Mill Creek, Chelsea/Revere, to confluence with Mystic River, Chelsea/East Boston/Charlestown.
Segment Area: 0.5 square miles.
Classification: Class SB, CSO*.
(* In the 2002 updated SWQS, Chelsea Creek will be designated SB/CSO. See Classification section.)



Land use estimates for this segment are unavailable.

Chelsea River (locally known as Chelsea Creek) is an urban river flowing from Boston's Inner Harbor, between East Boston and Chelsea to the mouth of Mill Creek, between Chelsea and Revere. (Mill Creek is the only area where direct access to the water is possible). For centuries, Chelsea Creek has been flanked by working industries, many of which used the channel to transport raw materials and finished goods. The Creek is officially classified as a Designated Port Area: a stretch of waterfront set aside primarily for industrial and commercial use. With a shipping channel dredged to 38 feet, the creek handles most of the oil tanker traffic in and out of the Port of Boston. Most of the petroleum delivered to this area is offloaded to facilities along its banks. Army Corps of Engineers (ACOE) embarked on a navigation improvement project for Boston Harbor to increase the depth of the channel in the Mystic River to 40 feet and in the Chelsea River to 38 feet. The project used an innovative concept in disposing of silty material in deep confined aquatic disposal cells dredged below the existing channel and capped with clean sand. The project dredging was scheduled to be completed by early November 2001. MA DEP has given ACOE permission to leave a confined disposal cell in Chelsea River uncapped for up to five years so that it can be used for future maintenance dredging (ACOE 31 October 2001).

In addition to these industrial uses, the City of Boston and MassPort store road salt directly on the banks of the Chelsea River.

This segment is on the 1998 303(d) list of impaired waters for unionized ammonia, organic enrichment/ low DO, pathogens, oil and grease, taste, odor, and color, and turbidity (MA DEP 1999a).

Urban Wilds are small parcels of existing, and reconditioned, natural habitats and parks within the greater Boston area. The Boston Parks and Recreation Department administer the Urban Wilds Initiative. The Urban Wilds Initiative has as its goals the protection of city owned urban wilds, the management and maintenance of urban wilds, and the promotion of use of urban wilds (City of Boston, 2000a). A new urban wild/park, called the Condor Street Urban Wild, is slated to be constructed on the banks of the Chelsea River in East Boston. This park will be the first of many derelict spaces transformed into a public park. From the early 1920's until 1976 the Condor Street Parcel was used as a cleaning facility for a sand and gravel company. The on-site contamination is mostly concrete debris. The land will be remediated employing the debris to form dune-like structures (Hargreaves Associates 2002). Construction of the park is scheduled to begin in the spring of 2002. Once constructed, this park will provide the only public access to Chelsea Creek. It is hoped that, in the future, Chelsea Creek will be cleaned-up and eventually opened to canoeing and kayaking, similar to the Charles River. Neighborhood of Affordable Housing/Chelsea Creek Action Group, in East Boston has successfully applied for a $10,000 State Technical Assistance Grant to hire a consultant to provide technical expertise as well as to develop educational materials for the public to help increase their understanding of and involvement in site cleanup activities. In 1999-2000, working with the Chelsea Creek Action Group and the Urban Ecology Institute, Save the Harbor/Save the Bay secured commitments of more than $1.5 million private, public and philanthropic funds to plan, permit and remediate Condor Street Urban Wild. Additionally, these funds will be used to build the first new park on either side of Chelsea Creek in a generation. In 2001, the Water's Edge Trust awarded Chelsea Creek $10,000 for an open space master plan. (Save the Harbor/Save the Bay undated).

WATER WITHDRAWAL SUMMARY:
There are no regulated water withdrawals from the Chelsea River Subwatershed.

NPDES SURFACE DISCHARGE SUMMARY:
The City of Chelsea (MA0101877) is permitted to discharge via three CSO outfalls to the Chelsea River. The permit expired 13 August 1998 and EPA expects to re-issue it in 2002.

Mobil Oil- East Boston, also known as TOSCO East Boston Terminal (MA00004006) is permitted to discharge oil/water separator discharge from storm water runoff to the Chelsea River. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$. The permit will expire 14 August 2005.

Glyptal (MA0003867) is permitted to discharge storm water to the Chelsea River. The permit includes an 83°F temperature limit, pH range 0f 6.5-8.5 and an oil/grease limit of 15 mg/L. The permit expired 30 September 1991.

Coastal Oil Chelsea Inc. (MA0004375) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH and PAH, has a TSS limit of 100 mg/L, and an oil/grease limit of 15 mg/L. The permit will expire 2 November 2002.

Gulf Oil LP a.k.a Catamount Petroleum. (MA0001091) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH, flow, VOC, and PAH, has a TSS limit of 100 mg/L, an oil/grease limit of 15 mg/L, and a benzene limit of 500µg/L. The permit will expire 2 November 2002.

Global Petroleum Corp. (MA0003425) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH, flow, VOC, and PAH, has a TSS limit of 100 mg/L, an oil/grease limit of 15 mg/L, and a benzene limit of 500µg/L. The permit will expire 2 November 2002.

Chelsea Sandwich, LLC (MA0003280) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH, flow, and PAH, has a TSS limit of 100 mg/L, and an oil/grease limit of 15 mg/L. The permit will expire 2 October 2005.

Global South Terminal LLC (MA0000825) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH, flow, VOC, and PAH, has a TSS limit of 100 mg/L, an oil/grease limit of 15 mg/L, and a benzene limit of 500µg/L. The permit will expire 2 November 2002.

Irving Oil Terminals (MA0001929) is permitted to discharge storm water to the Chelsea River. The facility is required to report pH, VOC, and PAH, has a flow limit, a TSS limit of 100 mg/L, an oil/grease limit of 15 mg/L, and a benzene limit of 500µg/L. The permit will expire 2 November 2002.

Global Revco Terminal LLC. (MA0003298) is permitted to discharge storm water via outfalls 001-006 to Sales Creek, in the Chelsea River subwatershed. The facility is required to report pH, flow, and PAH, and has a TSS limit of 100 mg/L, an oil/grease limit of 15 mg/L, and a benzene limit of 500µg/L. The permit will expire 2 November 2002.

Boston Inner Harbor will be reclassified as an SB_{CSO} water body under the updated 2002 Massachusetts Surface Water Quality Standards. The discharge of CSO in this segment is authorized in accordance with the final approved 1997 MWRA CSO Facilities Plan. Hydraulic relief projects and outfall improvements are proceeding in the Chelsea sewer system in accordance with the approved Plan. Discharges from active CSO outfalls will be limited to the frequency and volume established for a typical year under recommended plan conditions in the approved CSO Facilities Plan; discharges from active untreated outfalls are expected to occur less than four times per year on an average basis when the planned facilities are constructed. Floatables controls will be provided for all active CSO outfalls (Brander 2001a).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Between March 1999 and September 2000, Mobil Oil East Boston conducted five whole effluent toxicity tests using the shrimp, *Mysidopsis bahia*. There was no acute toxicity detected in any of the tests ($LC_{50} \geq 100\%$ effluent).

Chemistry – water

From 1996 through 2000, as part of their ongoing CSO monitoring program, MWRA collected monthly surface and bottom water quality samples (DO, temperature, and turbidity) at station 027, Inner Chelsea Creek, mid-channel (Coughlin 2001a).

DO

Bottom dissolved oxygen levels ranged from 1.62 to 9.93 mg/L with five samples below 5.0 mg/L. Bottom percent saturation levels ranged from 13.54 to 105.3% with four saturations below 60%. Surface dissolved oxygen levels ranged from 3.0 to 11.05 mg/L with two samples less than 5.0 mg/L. Surface percent saturation levels ranged from 13.62 to 143.3% with only 2 saturations below 60%. No samples (n=201) were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

No temperature readings (n=212) were above the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were taken on 117 occasions and ranged between 0 and 154 NTU with an average of 4.0 NTU.

On 8 June 2000 an oil spill occurred in Chelsea Creek, adjacent to the Chelsea Street Bridge connecting East Boston and Chelsea. After being struck by a tugboat, the 40,000-ton oil tanker *Posavina* spilled 58,000 gallons of No. 6 fuel into the river. Despite prompt Coast Guard efforts to mitigate the spill, fuel oil has appeared in other parts of the harbor (MA DEP 3 July 2000). On 17 August 2000, another 250-gallon spill occurred by the Sithe-Mystic power plant, and on 1 December 2000 a third spill of 600 gallons occurred at Global Revere Terminal.

Chemistry – sediments

The creek is one of the most polluted tributaries of Boston Harbor. Sediments are contaminated by years of polluted runoff from the adjoining industrial land areas, from shipping and from sewer outfalls (EPA 5 November 2001).

It is noted that dissolved oxygen concentrations in Chelsea River are improving, however, based on the urban nature of the watershed (>90%), resultant storm water runoff, the close proximity of multiple oil terminals, frequent oil spills, and contaminated sediments (historical data), the *Aquatic Life Use* for the Chelsea River is assessed as non-support.

FISH CONSUMPTION

In 1988, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory, the *Fish Consumption Use* is assessed as non-support for the Chelsea River.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH4.0 is prohibited (DFWELE 2000b).

Based on the prohibited status, the *Shellfishing Use* is assessed as non-support for 0.50 mi^2 of this segment of the Chelsea River.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of their ongoing CSO monitoring program, MWRA recorded Secchi disk depth readings at station 027 Inner Chelsea Creek, mid-channel (Coughlin 2001a). Secchi depths ranged from 1 to 5.5 m with only two of the 87 readings below 1.2 m. Chelsea River receives the untreated flow from three active CSOs. In 2000 multiple oils spills on the Chelsea River were reported. Most of the river is fenced and, therefore, access is restricted.

It is best professional judgment that, because of the aesthetic quality degradations described below, the recreational uses be assessed as non-support.

AESTHETICS

Chelsea River receives the untreated flow from three active CSOs. In 2000 multiple oils spills on the Chelsea River were reported. Additionally, the many oil terminals along the Chelsea River frequently cause heavy oil odors. Access to the river is restricted for its entire length and the majority of the banks are seawalls with limited to no vegetation in the riparian zone.

More than 130 barrels of small debris, 300 pieces of large debris, and 30 pieces of piers and other oversized debris were collected between July 1, 2000 and September 15, 2000 during the pilot year of the Boston Harbor Marine Debris Salvage Program. Debris was collected from "high activity areas" such as the downtown waterfront, the Charlestown Navy Yard, the East Boston waterfront, South Boston waterfront, the Outer Fort Point Channel, and Chelsea Creek. Additionally, more than 57 tons were collected in 2001 (East Boston 21 August 2000).

The *Aesthetics Use* is assessed as non-support due to aesthetic quality degradation (e.g., frequent oil spills, multiple CSOs, trash and debris) in the Chelsea River.

Chelsea River (MA71-06) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NON-SUPPORT	Oil & grease, unknown	Metals, priority organics, turbidity	Urban runoff/storm sewers, industrial point sources, contaminated sediments, spills	
Fish Consumption		NON-SUPPORT	Unknown toxicity		Unknown	
Shellfishing		NON-SUPPORT 0.50 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		NON-SUPPORT	Oil & grease, taste & odor, unknown, trash & debris	Turbidity, pathogens	Urban runoff/storm sewers, industrial point sources, spills, CSO	
Secondary Contact		NON-SUPPORT	Oil & grease, taste & odor, unknown, trash & debris	Turbidity, pathogens	Urban runoff/storm sewers, industrial point sources, spills, CSO	
Aesthetics		NON-SUPPORT	Oil & grease, taste & odor, unknown, trash & debris	Turbidity	Urban runoff/storm sewers, industrial point sources, oil spills, CSO	

RECOMMENDATIONS CHELSEA RIVER (MA71-06)

- The EOEA Watershed Team should work with state and federal agencies (e.g., DEP, CZM, USGS, ACOE) to conduct biological monitoring (e.g. benthic macroinvertebrates, fish population) to determine if the effect(s) of NPDES discharge(s) and habitat quality negatively impact the aquatic life in this segment of the Chelsea River.

- Mobile Oil East Boston (MA0004006) should collect water from the Chelsea River upstream of their discharge to use as dilution water in their whole effluent toxicity tests. If the river water does not meet the control test acceptability criteria (e.g., survival > 80% at 7-day), then Chelsea River water must still be utilized as a test control and not as diluent.

- Work with local citizens and stream teams to remove/reduce the trash and debris in the Chelsea River and on land adjacent to the river.

- Conduct compliance inspections of the oil terminals on the Chelsea River to determine if the facilities have implemented their pollution prevention plans as required in their NPDES permits.

- Continue to work with MassPort, Eastern Minerals Salt Company, and the City of Boston to better contain the road salt piles along the Chelsea River (e.g., covering, containment booms).

- Work with local, state, and federal agencies including Chelsea Green Space, Urban Wilds Initiative, Save the Harbor/Save the Bay, to implement the Condor Street Urban Wild project and to improve public access to the Chelsea River through Brownfield reclamation, parks development and urban wild restorations.

- Continue to support the Boston Harbor Marine Debris Salvage Program.

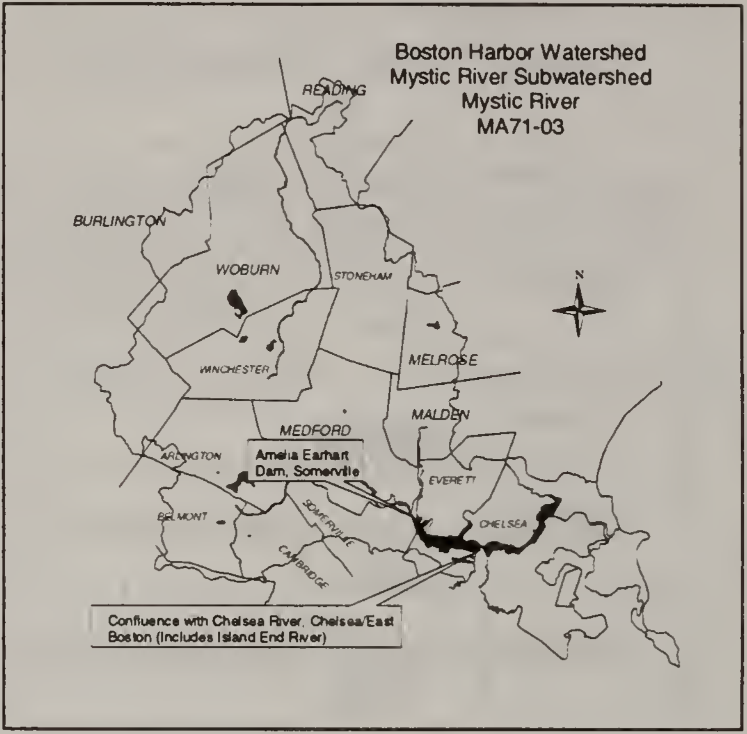
- Assess the implementation and success of the NPDES Phase I Storm water plan for East Boston on reducing impacts from urban runoff.

MYSTIC RIVER (SEGMENT MA71-03)

Location: Amelia Earhart Dam, Somerville to confluence with Chelsea River, Chelsea/East Boston (Includes Island End River).
Segment Area: 0.7 square miles.
Classification: Class SB, Shellfishing (Restricted), CSO.
(In the 2002 updated SWQS, this segment of the Mystic River will be reclassified as SB/CSO. See Classification section.)

Land use estimates for this segment are not available.

This segment is on the 1998 303(d) list of impaired waters for unionized ammonia, organic enrichment/ low DO, pathogens, oil & grease, taste, odor, & color, and turbidity (MA DEP 1999a). ACOE embarked on a navigation improvement project for Boston Harbor to increase the depth of the channel in the Mystic River to 40 feet. The project used an innovative concept in disposing of silty material in deep confined aquatic disposal cells dredged below the existing channel and capped with clean sand. The project dredging was scheduled to be completed by early November 2001. The final capping of the last of the confined aquatic disposal cells in the Mystic River was completed in August 2000 (ACOE 31 October 2001).



WATER WITHDRAWAL SUMMARY:
There are no regulated water withdrawals from this segment of the Mystic River.

NPDES SURFACE DISCHARGE SUMMARY:
Exxon Everett - Everett (MA0000833) is permitted (April 2000) to discharge holding tank #140 discharge via outfall 001A and holding tank 140 bypass via 001B to the Mystic River/Island End. The facility's whole effluent toxicity limit is LC_{50} >50%.

Monsanto Corporation- Everett (MA0000809) was permitted to discharge to the Mystic/Malden River. The facility ceased operations in the late 1990's.

In 1990 Cabot Power Corporation filed for approval with the Executive Office of Environmental Affairs to construct, own, and operate a 350-megawatt, gas-fired, combined-cycle cogeneration power plant in the Island End Industrial Park, Everett, MA. The facility has not been and may not be constructed. As part of the process, Cabot Power Corp applied for and received an NPDES permit. When that permit expired, EPA issued the Island End Cogeneration Project a new NPDES permit (MA0040126) that allows the facility to discharge 40,000 GPD of floor drain and boiler blowdown water to the Mystic River/Island End River via outfall 001and includes a TSS limit of 30 mg/L and an oil and grease limit of 15 mg/L. The permit MA0040126 will expire in May 2005.

Allied Concrete Corp. (MA0002038) is permitted to discharge 2000 GPD to the Island End River. The facility's permit includes a TSS limit of 2.5 mg/L.

Sithe Mystic (MA0004740) is permitted to discharge 754 MGD from four power generation units to Mystic River subwatershed. The permit contains a 93 °F temperature limit and a 0.1mg/L total residual chlorine limit (2 hour max; one unit at time). The permit was reissued in 2001.

Distrigas of Massachusetts Corp. (MA0020010) is permitted to discharge operation wastewater and storm water to the Mystic River Channel. This natural gas distributor was required to implement a BMP plan. The permit was reissued in 2001.

The City of Chelsea (MA0101877) is permitted to discharge via one CSO to the Mystic River. The permit expired 13 August 1998. The permit is expected to be reissued in 2002.

Boston Inner Harbor is an SB $_{CSO}$ waterbody under the Massachusetts Surface Water Quality Standards. The discharge of CSOs in this segment is authorized in accordance with the final approved 1997 MWRA CSO Facilities Plan. These CSOs are permitted to MWRA, Boston Water & Sewer Commission, and the City of Chelsea. The approved Facilities Plan includes a combination of sewer separation, CSO storage, and CSO treatment facilities. These improvements will substantially mitigate CSO discharges at these outfalls. Discharges from active CSO outfalls will be limited to the frequency and volume established for a typical year under recommended plan conditions in the approved CSO Facilities Plan; discharges from active untreated outfalls are expected to occur less than four time per year on an average basis when planned facilities are constructed. Floatables controls will be provided for all active CSO outfalls (Brander 2001a).

Under NPDES permit number MA0103284 MWRA is permitted (issued 2001) to discharge CSO from the Somerville Marginal CSO Treatment Facility (MWR 205) to the Mystic River, just downstream from the Amelia Earhart Dam. The facility is required to conduct and report on the results of two whole effluent toxicity tests annually. This outfall also has average discharge event TRC limits of 0.1 mg/L. MWRA has upgraded the facility to improve treatment performance and meet new chlorine residual discharge limits.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Between March 1996 and March 2001, Exxon Everett conducted 17 whole effluent toxicity tests using the shrimp, *M. bahia*. There was no acute toxicity detected in any of the tests ($LC_{50} \geq 100\%$ effluent). TRC concentrations at both outfalls ranged from BDL to 0.3 mg/L. Four tests were conducted on effluent from outfall 001B between 12 September 1999 and 22 March 2001. The effluent from this outfall was not acutely toxic to the test organism.

Between September 1995 and September 1996, Mosanto Everett conducted three whole effluent toxicity tests using the shrimp, *M. bahia*. *M. bahia* LC_{50}'s ranged from 83 to 100% effluent.

In October 2000 and January 2001, MWRA Deer Island (MA0103284) conducted two whole effluent toxicity tests using the mysid shrimp, *M. bahia* and the inland silverside, *M. beryllina* on Somerville Marginal CSO Pretreatment facility outfalls. Additionally, in March 2001, two whole effluent toxicity tests were conducted using the fathead minnow, *P. promelas* and the water flea, *C. dubia*. The CSO discharges were not acutely toxic to any test organism in any test event.

Chemistry – water

From 1996 to 2000, as part of their ongoing CSO monitoring program, MWRA collected monthly surface and bottom water quality samples (DO, temperature, and turbidity) at three stations on this segment of the Mystic River. Additionally, TSS samples and chlorophyll *a* samples were collected at station 137 (Coughlin 2001a and 2002):

052- Mystic River at Somerville Marginal, downstream of dam
069- Mystic River near Schraffts BOS 017
137- Mystic River Mouth, 1/3 –mile upstream of Tobin Bridge

DO

Dissolved oxygen concentrations ranged between 1.38 and 17.53 mg/L (n=626) with 34 bottom concentrations and five surface concentrations below 5.0 mg/L all during summer months. Percent saturation levels ranged from 8.66 to 167.9% with 28 saturations below 60% and 13 greater than 115% (n=626). No measurements were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature measurements (n=663) were below the SWQS for a class SB estuary.

Turbidity

Turbidity measurements ranged between 0 and 369 NTU (n=360) with an average less than 10 NTU. Ten of the 360 measurements were greater than 25 NTU and three measurements, collected during dry weather conditions, were greater than 100 NTU.

Chlorophyll-a

Bottom chlorophyll *a* concentrations ranged from 0.19 to 19.4 µg/L (n=185) while surface concentration ranged from 0.21 to 49.2 µg/L with and average of 5.33 (n=185).

Suspended Solids

TSS measurements taken on 354 occasions with bottom concentrations ranging from 0.87 to 115 mg/L (average 7.62 mg/L) and surface concentrations from 1.11 to 10.2 mg/L (average 4.72 mg/L).

Chemistry – sediments

Eastern Gas & Fuel Co. owned a coal gasification plant property, including a coal tar processing facility on the Island End River. The site is classified as a Tier IA disposal site by MA DEP. The facility as a whole operated from the late 1800's until the 1960's, as a coal gasification plant (extracting natural gas from coal). The Former Coal Tar Processing Facility was a portion of the plant which took in the tars that were a byproduct of the gasification process, and processed them into various consumer products: roofing and roadway materials, resins, dyes, etc. Wastes associated with these products were improperly disposed of and when the facility was shut down in the 1960's large quantities of waste tars were left behind. Immediately adjacent to the Former Coal Tar Processing Facility, large quantities of separate-phase tars are intermingled with the sediments, to a depth of approximately twelve feet below the river bottom. These separate-phase tars well up from the bottom regularly, creating sheens and odors. There is also a great deal of coal tar contamination in upland portions of the site. The most recent environmental risk assessment was completed by Ogden Environmental, Inc. in July 2000 for the Primary Responsible Parties and will be compiled into a final version to be submitted to MA DEP. During the next phase, work will be done to characterize the impacts and risks to the benthic communities (Roberson 2002).

The Aquatic Life Use is assessed as non-support for the portion of this segment that encompasses the Island End River due to contaminated sediments. Based on water chemistry data (DO, temp, turbidity, TSS) the remaining 0.67square miles of this segment of the Mystic River are assessed as support. This segment is, however, on "Alert Status" due to organic enrichment/low DO in the bottom waters during summer months.

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels…
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves…"

Based on the MDPH seafood fish consumption advisory, the *Fish Consumption Use* is assessed as non-support for this segment of the Mystic River.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH4.0 is prohibited (DFWELE 2000b).

Based on the prohibited status, the *Shellfishing Use* is assessed as non-support for 0.7 mi^2 of this segment of Mystic River.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

The MWRA collected fecal coliform bacteria samples at their three CSO outfall monitoring stations (see above) between 1996 and 2000 as part of their ongoing CSO monitoring program (Coughlin 2001a and 2002). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged from <5 to 1,340,000 cfu/100mL (n=719) with 52 counts greater than 2,000 cfu/100mL and 36 counts greater than 4,000 cfu/100mL. During the primary contact season, fecal coliform bacteria counts ranged between <5 and 1,340,000 cfu/100mL (n=495) with 89 counts greater than 400 cfu/100mL. It should be noted that the highest count was collected during dry weather at station 052 in the vicinity of the Somerville Marginal CSO Treatment Facility in July of 1997 and that of the 105 surface samples collected at this station, 51 were greater than 400 cfu/100mL (49%) and 30 were greater than 4,000 cfu/100mL. At stations 069 and 137, only 21 (6%) of the 324 samples were greater than 400cfu/100mL and six were greater than 4,000 cfu/100mL during wet weather.

Additionally, MWRA recorded 401 Secchi disk depths between 1996 and 2001 at their three CSO outfall monitoring stations. Secchi disk depths ranged from 0.3 to 6 m with 37 measurements less than 1.2m. The Secchi disk could be seen on the bottom on 21 occasions.

In the vicinity of the Somerville Marginal CSO Treatment Facility, the *Primary and Secondary Contact Recreational uses* are assessed as non-support for 0.01 sq miles due to elevated fecal coliform bacteria counts in both wet and dry weather conditions. Additionally, the area of this segment that encompasses the Island End River (0.03 square miles) is also assessed as non-support due to aesthetic quality degradation (see below). The remaining 0.66 square miles are assessed as partial support, due to elevated counts in wet weather. It should be noted that in the 2002 updated SWQS this segment of the Mystic River will be reclassified as a Class SB_{cso} waterbody.

AESTHETICS

The Mystic River receives the flow from several CSOs. Additionally, the oil terminals in the Mystic River subwatershed cause oil odors. Access to the river is restricted for most its length and the majority of the banks are seawalls with limited to no vegetation in the riparian zone. Noxious odors and sheens from contaminated sediments associated with the former Eastern Gas and Fuel Company are common on the Island End River.

The Aesthetics Use is assessed as non-support for 0.03 square miles, the portion of this segment that encompasses the Island End River, and the remaining 0.67 square miles are not assessed.

Mystic River (MA71-03) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		NON-SUPPORT 0.03 mi^2 SUPPORT* 0.67 mi^2	PAHs, metals, other inorganics		Contaminated sediments	
Fish Consumption		NON-SUPPORT	Priority organics		Unknown	
Shellfishing		NON-SUPPORT 0.7 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		NON-SUPPORT 0.04 mi^2 PARTIAL SUPPORT 0.66 mi^2	Pathogens		CSO, urban runoff/storm sewers	
Secondary Contact		NON-SUPPORT 0.04 mi^2 PARTIAL SUPPORT 0.66 mi^2	Pathogens		CSO, urban runoff/storm sewers	
Aesthetics		NON-SUPPORT 0.03 mi^2 NOT ASSESSED 0.67 mi^2	Odors, oil sheens		Contaminated sediments	

* "Alert Status" issues identified—See *Aquatic Life Use* assessment

RECOMMENDATIONS MYSTIC RIVER (MA71-03)

- Exxon Everett (MA0000833) should collect water from the Mystic River upstream of their discharge to use as dilution water in their whole effluent toxicity tests. If the river water does not meet the control test acceptability criteria (e.g., survival > 80% at 7-day), then Mystic River water must still be utilized as a test control and not as diluent.

- Work with local citizens and stream teams to remove/reduce the trash and debris in the Mystic River.

- Conduct compliance inspections of the oil terminals on the Mystic River to determine if the facilities have implemented their storm water pollution prevention plans as required in their NPDES permits.

- Work with local, state, and federal agencies to improved public access to the lower Mystic River through Brownfield reclamation, parks development and urban wild restorations.

- When and if the Island End Cogeneration facility assumes operation, reevaluate their current NPDES permit (MA0040126) and determine if temperature limits and whole effluent toxicity testing requirements are warranted.

MYSTIC RIVER SUBWATERSHED- LAKE ASSESSMENTS

A total of 50 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned Pond and Lake Information System (PALIS) code numbers in the Mystic River Subwatershed (Ackerman 1989 and MA DEP 2001b). These lakes represent a total surface area for the Mystic River Subwatershed lakes of 1,482.9 acres. They range in size from one to 307 acres; 37 lakes are less than 50 acres, five are greater than 100 acres, and, of these, one is greater than 200 acres. Information on 10 of the lakes are reported here, and stored in the WBS database. The other 40 lakes, which total 1,011 acres, are unassessed, and they are not currently included as segments in the WBS database.

Lake assessments are based on information gathered during DWM surveys (recent and historic) as well as pertinent information from other sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). The 10 lakes assessed in this report represent 381.9 of the 1,482.9 or 26% of the acreage in the Mystic River Subwatershed (Figure 15). Seven of the lakes assessed are less than 50 acres in total surface area.

During the summer of 1999, intensive in-lake sampling was conducted by DWM on two lakes (Lower Mystic Lake and Winter Pond) as part of the Mystic River Subwatershed Baseline Lakes Survey. This sampling included in-lake measurements of dissolved oxygen, pH, temperature, Secchi disk transparency, nutrients, and chlorophyll *a*, as well as detailed macrophyte mapping. While these surveys provided additional information to assess the status of the designated uses, fecal coliform bacteria data were not available and, therefore, the *Primary Contact Recreational Use* for Lower Mystic Lake was not assessed and Winter Pond was assessed based on macrophyte cover. No other lakes in this subwatershed were assessed for the *Primary Contact Recreational Use* due to lack of current bacteria data and detailed macrophyte coverage.

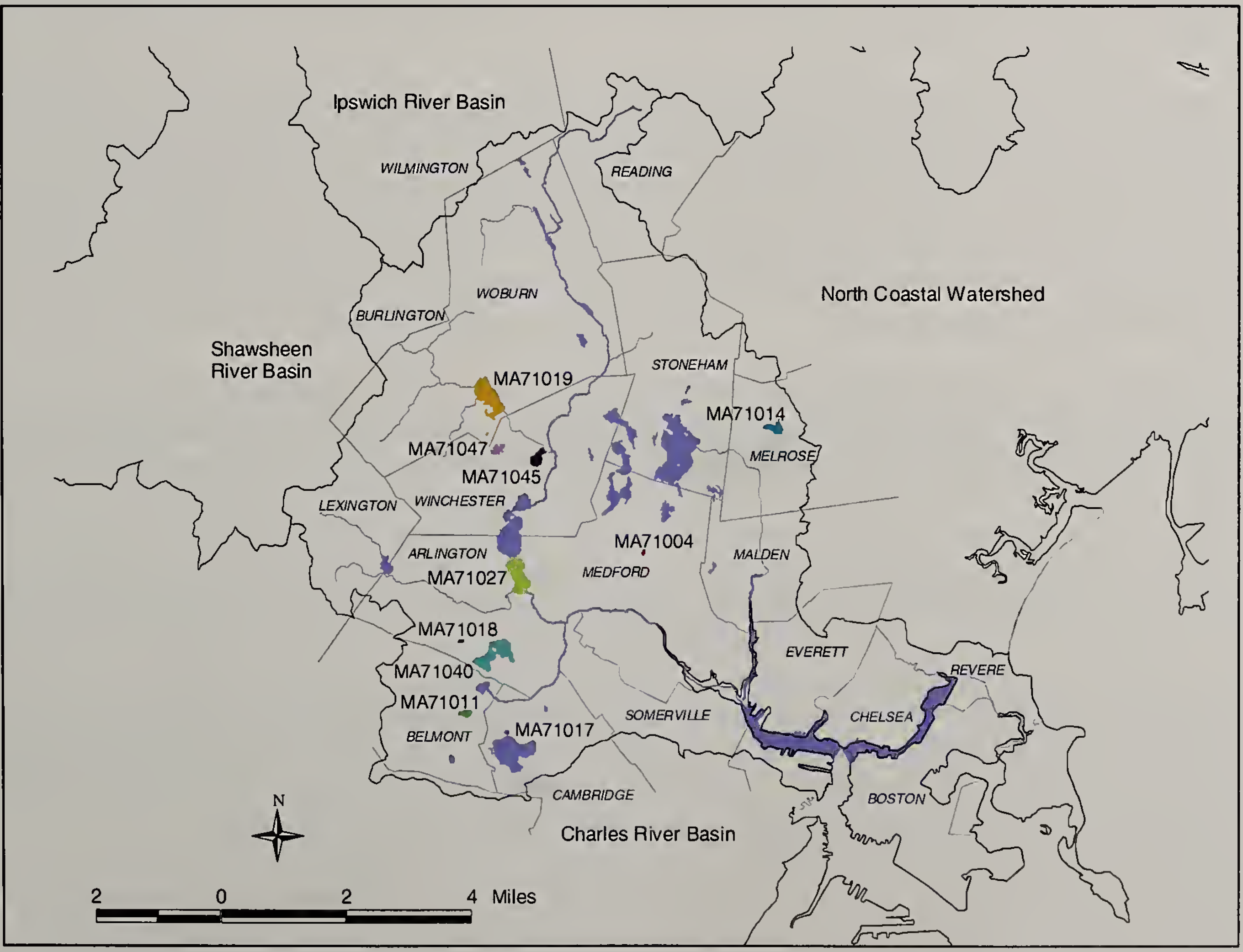


Figure 15. Lake segments in the Mystic River Subwatershed

In the case of the *Fish Consumption Use*, fish consumption advisory information was obtained from the Massachusetts Department of Public Health (MDPH 2001). The use assessments and supporting information were entered into the EPA WBS database.

It should be noted that Judkins and Mill ponds are not included in the lakes assessment section of this report. These two pond segments are impoundments of the Aberjona River and therefore are not assessed as ponds. The designated use status of these two impounded ponds is derived from the assessments of the Aberjona River (Segment MA71-01).

AQUATIC LIFE

Lower Mystic Lake is a meromictic lake, meaning that a noncirculating bottom layer does not mix with the circulating upper layer. In Lower Mystic Lake, the deepest waters contain high concentrations of sea water (and CH_4 and H_2S) and are denser than the surface waters (Ludlam and Duval 2001). These conditions were first noted in 1857. In 1860, the chemocline (the chemical boundary separating the circulating and noncirculating layers or water masses of a lake) was described as being 5-6m below the surface. Before completion of the Craddock Dam and Locks in 1908, saltwater entered Lower Mystic Lake and recharged the high-density, stable, stagnant or noncirculating lower layer. After the dam was completed, saltwater could still enter the lake during operation of the locks. The up welling of the gas-laden (H_2S) deep waters caused a fish kill in 1965 that involved alewives migrating down from Upper Mystic Lake.

The Amelia Earhart dam was designed to prevent any further influx of saltwater to the lake. This dam was completed in 1966, and the operation of the Craddock Locks was discontinued in 1968. By this time, natural processes had removed more than 80% of the monimolimnion. However, the MDC decided to remove the remaining sulfide-laden waters by pumping them out of the lake. Water was pumped from a depth of ~3m above the deepest point. Approximately 240,000 cubic meters of the lake (below the chemocline) were removed. This pumping operation ran sporadically from 1982 until 1990 when it was finally curtailed (Ludlam and Duval 2001).

In 1999, DWM water quality sampling of Lower Mystic Lake, Medford identified oxygen depletion in the bottom waters and in the thermocline (Appendix B, Table B3). Therefore, the *Aquatic life Use* is assessed as non-support for Lower Mystic Lake. The salt layer was also very high in phosphorus indicating an internal nutrient-loading problem. A sediment toxicity study was conducted on Lower Mystic Lake (Ivushkina 1999). In the one sample analyzed As, Cr, Cu, Pb and Zn concentrations were above their respective S-ELs. Although the sediment data were too limited for assessment purposes, contaminated sediments are of concern.

It should be noted that in 2000 MyRWA collected water quality samples from Mill Brook (at Mt. Pleasant Cemetery, Arlington), a tributary to Lower Mystic Lake (MyRWA 2001). Based on the available data (elevated TSS and TP), this brook is suspected as a source of impairment for the Aquatic Life Use in Lower Mystic Lake.

The 1999 DWM water quality sampling in Winter Pond identified high dissolved oxygen concentrations in the surface waters, coupled with high percent saturations and high concentrations of total phosphorus (as P) (Appendix B, Table B3). Therefore, the *Aquatic Life Use* is assessed as partial support for Winter Pond. Although the sources of impairment are unknown, urban runoff/ storm sewers are suspected to contribute nutrients to the pond. In June 1999 this pond was treated with two herbicides (SONAR and Rodeo) to control the growth of aquatic and wetland plants (MA DEP 2000b). Although no non-native aquatic plants were identified during DWM's 1999 surveys (MA DEP 1999e) the non-native wetland species, Purple Loosestrife (*Lythrum salicaria*) was identified in Winter Pond (Appendix B, Table B2).

Subsequent to a 1986 Diagnostic/Feasibility Study of Hills Pond a lake restoration project was undertaken by the Town of Arlington. As part of this restoration the pond was drained and dredged in 1993. Additionally, a storm water management system was installed to reduce sediment inputs and nutrient loadings. The pond was drained and dredged again in 1994. By 1995, the pond was finally refilled with water, restocked with fish, and the banks and peripheral wetlands were graded and revegetated (Fugro

East Inc. 1996). Not enough current water quality data were available to assess the *Aquatic Life Use*; therefore, it is not assessed.

In 1997 and 1998 sediment toxicity analyses were conducted at Spy Pond in Arlington (Ivushkina 1999). Both surface and core samples were analyzed for trace elements including As, Cd, Cr, Cu, Pb and Zn. Multiple parameters were above both the L-EL and S-EL in the surface samples (Cu, Pb, and As). Although the sediment data were too limited for assessment purposes contaminated sediments are of concern. Aquatic Control Technologies performed a Baseline Aquatic Vegetation Survey of Spy Pond in November 1999 (Smith, 2000). The survey identified excessive aquatic vegetation growth exacerbated by the non-native Eurasian milfoil (*Myriophyllum spicatum)*. The possible path of downstream spreading of Eurasian milfoil from Spy Pond to other waterbodies is presented below.

Spy Pond (Arlington) ⇒ unnamed tributary (below ground) ⇒ Little Pond (Belmont) ⇒ Little River ⇒ Alewife Brook ⇒ Mystic River.

Based on the presence of a non-native aquatic macrophyte, the *Aquatic Life Use* for Spy Pond is assessed as partial support.

FISH CONSUMPTION

The MDPH fish consumption advisory list contains the status of each water body for which an advisory has been issued. If a water body is not on the list, it may be because either an advisory was not warranted or the water body has not been sampled. MDPH's most current Fish Consumption Advisory list is available online at http://www.state.ma.us/dph/beha/fishlist.htm.

In 1999 DWM conducted fish toxics monitoring on Lower Mystic Lake. Composite skin-off fillets of common carp, largemouth bass, white perch and yellow perch were analyzed for priority organics, metals, and pesticides (Appendix B, Table B7). No contaminants were identified at concentrations above the MDPH action levels.

MDPH issued a fish consumption advisory for Clay Pit Pond in 1996 due to elevated levels of chlordane in fish tissue. The advisory recommends that the general public should not consume any fish from this waterbody (MDPH 2001). Therefore, Clay Pit Pond is impaired (non-support due to chlordane contamination) for the *Fish Consumption Use* (Table 6).

No other lakes in the Mystic River Subwatershed currently have individual fish consumption advisories; therefore, they are not assessed for fish consumption use.

In July 2001, MDPH issued new statewide consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."

Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. The statewide advisory encompasses all freshwaters in

Massachusetts and, therefore, the *Fish Consumption Use* for lakes in the Mystic River Subwatershed cannot be assessed as support or partial support.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

The five Secchi disk depth measurements (Appendix B, Table B5) collected by DWM from Lower Mystic Lake were all greater than 1.2 m (the bathing beach standard), however, no fecal coliform bacteria data were collected. Therefore, the *Primary Contact Recreational Use* is not assessed. Low densities of aquatic plants and algae were documented during the 1999 survey. Additionally, no objectionable conditions were noted (i.e., odors, trash, oil sheens). The *Secondary Contact Recreational* and *Aesthetics Uses* of Lower Mystic Lake are assessed as support (Table 6). It should be noted that in 2000 MyRWA collected water quality samples from Mill Brook (at Mt. Pleasant Cemetery, Arlington), a tributary to Lower Mystic Lake (MyRWA 2001). Based on the elevated fecal coliform bacteria counts, this brook is suspected as a possible source of bacteria to Lower Mystic Lake.

One of the three Secchi disk depth measurements (Appendix B, Table B5) collected by DWM from Winter Pond was less than 1.2 m (the bathing beach standard). Therefore, the *Primary Contact Recreational Use* is assessed as partial support. Although sources of this impairment are currently unknown, urban runoff/storm sewers are suspected to contribute to the decreased water clarity. While sparse aquatic plants or algae were identified during the September 1999 survey, the pond had been treated with herbicides in June to control the growth of aquatic plants. Additionally, no objectionable conditions were noted (i.e., odors, trash, oil sheens). The *Secondary Contact Recreational* and *Aesthetics uses* of Winter Pond are assessed as support (Table 6).

No lakes in the Mystic River Subwatershed were assessed as supporting the *Primary Contact Recreational Use.* Eight lakes in the Mystic River Subwatershed (not discussed above) are currently not assessed for the *Recreational* and *Aesthetics* uses (Table 6).

SUMMARY

Only two lakes in this subwatershed were assessed for any uses (Lower Mystic Lake and Winter Pond). Site-specific sources of impairment to these lakes are largely unknown. However, nutrient enrichment from storm water runoff is likely to have increased the macrophyte productivity and decreased the water clarity resulting in impairments to the *Aquatic Life*, *Recreational,* and *Aesthetics* uses.

Table 6 presents the use assessments for the lakes in the Mystic River Subwatershed.

RECOMMENDATIONS – LAKES

- Mystic River Watershed Association, with the assistance of Tufts University and EPA, conducted water quality monitoring between June and October 2000 to better understand the temporal and spatial variations in nutrient levels in Upper Mystic Lake. Samples were collected from the Aberjona River at the USGS gauging station in Winchester, the outlet of the lake (discharge structure on the dam separating Upper and Lower Mystic), and three sites along a vertical transect at a single fixed location in the deepest part of the lake. Parameters measured included depth/flow, temperature, pH, dissolved oxygen, conductivity, total dissolved solids, total suspended solids, total Kjeldahl nitrogen, nitrate/nitrite, sulfate, bromide, chloride, fluoride, ammonia, total phosphorus, ortho-phosphate, total organic carbon (dissolved organic carbon), alkalinity, and chlorophyll. It is recommended that Upper Mystic Lake be added to the WBS and that the data and final report from this study be reviewed to assess the designated uses of Upper Mystic Lake.

- Coordinate with DEM and/or other groups conducting lake surveys to generate quality assured lake data. Conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds, they should be eliminated or, at least, minimized through the application of appropriate point or non-point source control techniques.

- Implement recommendations identified in the TMDLs and lake Diagnostic/Feasibility studies, including lake watershed surveys to identify sources causing impairment.

- For non-native aquatic plant species that are isolated to one or a few location(s), quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations (Table 6), to determine the extent of the infestation. And, "spot" treatments (refer to the draft Generic Environmental Impact Report for Eutrophication and Aquatic Plant Management in Massachusetts [Mattson et al, 1998] for advantages and disadvantages) should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand-pulling individual plants in small areas. In larger areas, other techniques such as selective herbicide application may be necessary. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These precautions will minimize the spreading of the populations. This draft aquatic plant report (Mattson et al, 1998) should be consulted prior to the development of any lake management plan to control non-native aquatic or wetland plant species.

- Conduct follow-up monitoring at Hills Pond to determine if the Restoration Project was effective.

- Determine the fishing pressure on Spy Pond and if warranted conduct fish toxics monitoring.

Table 6. Mystic River Subwatershed Lake Assessments. (**Bold** indicates 303 (d) listed waters).

LAKE	Waterbody Identification Code WBID	SIZE Acres	AQUATIC LIFE *Causes*	FISH CONSUMPTION *Causes*	PRIMARY CONTACT *Causes*	SECONDARY CONTACT *Causes*	AESTHETICS *Causes*
Bellevue Pond, Medford	MA71004	3.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Blacks Nook, Cambridge	MA71005	2.5	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Clay Pit Pond, Belmont	MA71011	13.0	Not Assessed	NON-SUPPORT *Chlordane*	Not Assessed	Not Assessed	Not Assessed
Ell Pond, Melrose	MA71014	22.4	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Hills Pond, Arlington	MA71018	2.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Horn Pond, Woburn	MA71019	104.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Lower Mystic Lake, Medford	MA71027	93	NON-SUPPORT *Unknown, organic enrichment/low DO, salinity*	Not Assessed	Not Assessed	SUPPORT	SUPPORT
Spy Pond, Arlington	MA71040	103.0	PARTIAL SUPPORT *Non-natives*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Wedge Pond, Winchester	MA71045	22.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Winter Pond, Winchester	MA71047	17.0	PARTIAL SUPPORT *Unknown, nutrients*	Not Assessed	PARTIAL SUPPORT *Turbidity*	SUPPORT	SUPPORT

NEPONSET RIVER SUBWATERSHED- RIVER AND ESTUARY SEGMENT ASSESSMENTS

School Meadow Brook (Segment MA73-06) 91
Tubwreck Brook (Segment MA73-07) 93
Mill Brook (Segment MA73-08) 95
Mine Brook (Segment MA73-09) 97
Unnamed Tributary (Segment MA73-10) 100
Mill Brook (Segment MA73-12) 101
Bubbling Brook (Segment MA73-11) 103
Unnamed Tributary (Segment MA73-13) 104
Unnamed Tributary (Segment MA73-14) 105
Germany Brook (Segment MA73-15) 106
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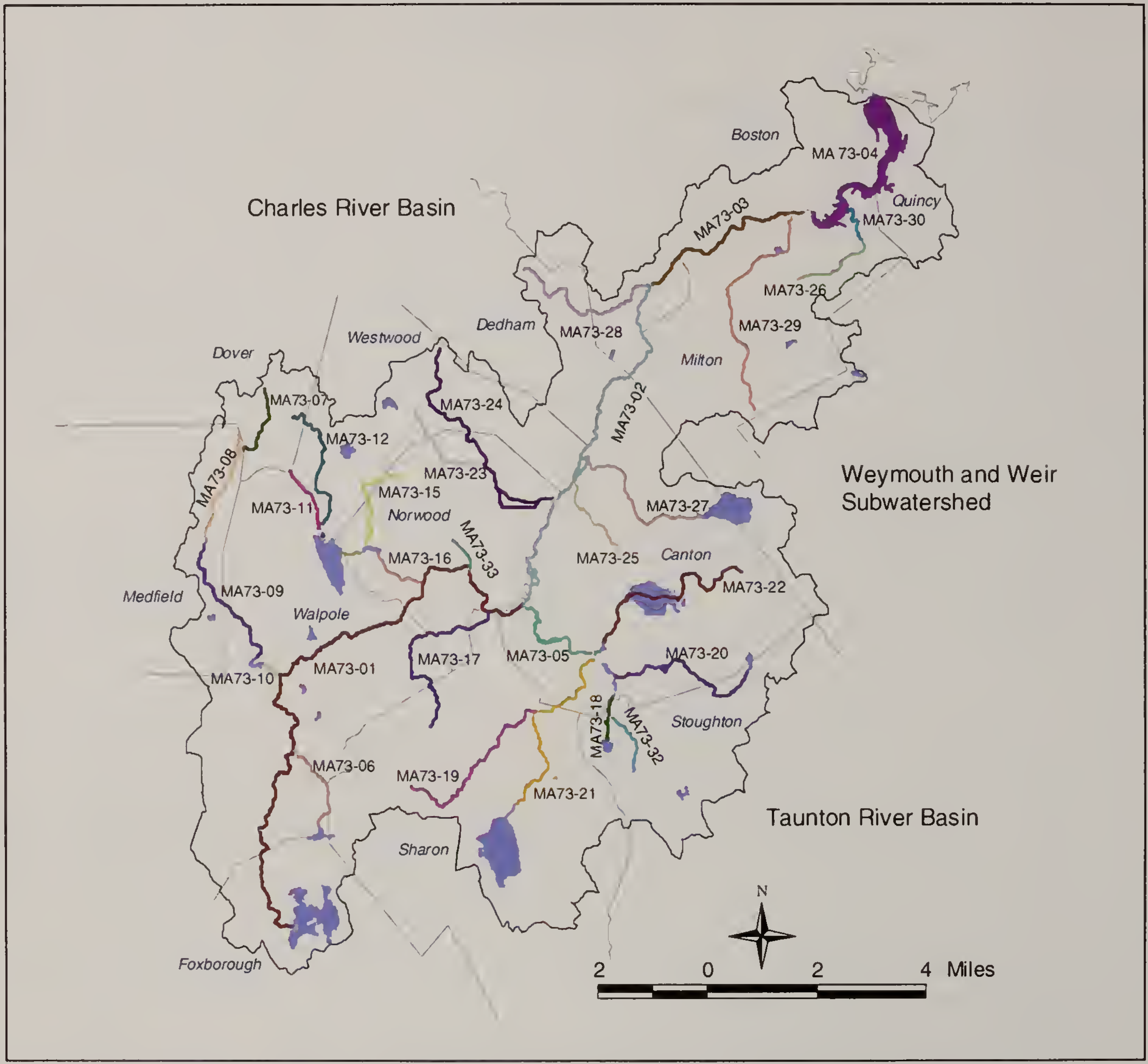


Figure 16. River/Estuarine Segments in the Neponset River Subwatershed

GENERAL ISSUES/RECOMMENDATIONS FOR THE NEPONSET RIVER SUBWATERSHED

Water quantity is an important issue throughout the Boston Harbor Watershed. The majority of public water, whether from local supplies or through the interbasin transfer of water from Quabbin Reservoir in central Massachusetts by the MWRA, is processed at the MWRA's Deer Island Wastewater Treatment Plant and discharged to Massachusetts Bay, bypassing local streams. Recharge of the local systems is mainly limited to precipitation events and low streamflow is a serious problem.

Above and beyond the water brought in from the Quabbin or water pumped from local aquifers, the sewer collection system drains an even larger amount of clean rain water and ground water from the Boston Harbor Watershed in the form of inflow and infiltration -- water which finds its way into the sewer system through cracks, poor joints, and illegal cross connections. Inflow and Infiltration accounts for approximately 60% of overall sewer flow in the MWRA collection system, with some communities showing I/I rates of up to 75%. The overwhelming majority of the I/I problems are associated with municipal portions of the regional sewer system and not with the MWRA owned/operated lines. The municipal element includes both I/I in the 5,400+ miles of sewer lines owned/maintained by the municipality, and the 5,000+ miles of privately owned lateral connections. Infiltration is a major problem relative to groundwater loss. Inflow is most often associated with storm events and peak flows and tends to be a major cause of Sanitary Sewer Overflows/backups. This loss of water essentially reduces available streamflow, and threatens instream uses such as aquatic life, habitat quality and quantity and recreational uses. A comprehensive regional I/I control program, involving the MWRA, municipal and privately owned sections of the sewer, should be developed to identify and remove sources of inflow and infiltration. A key component of the program is to develop a preventive and reactive Operation, Maintenance and Rehabilitation program; without Operation, Maintenance and Rehabilitation, sewer systems will continue to deteriorate and I/I will increase (Cooke and Lipman 2002).

Strong conservation measures through implementation strategies such as block rate pricing, installation of water-saving devices in homes and public buildings, and tying outdoor water use restrictions to streamflow levels, in concert with a strong educational program, will all help reduce the stress placed on the water resources throughout the Boston Harbor Watershed (Cooke and Lipman 2002).

Bacteriological contamination of waterbodies is a concern in the Neponset River Subwatershed and throughout the Boston Harbor Watershed. Pathogens may enter a waterbody as point or non-point source pollution. Point sources in the watershed are generally addressed under the National Pollutant Discharge Elimination System permitting program. Nonpoint source pollution can include urban runoff, faulty septic systems, and illegal/cross connections between the sewer and stormdrain systems. To improve water quality in the Neponset River Subwatershed, EPA/MA DEP sent letters to two communities (Milton and Norwood), requesting information regarding dry weather discharges from storm water discharge pipes. Included in the information requested are maps of the location and size of the municipal storm water outfalls; maps of the location of any combined sewer/stormdrain manholes, sewer underdrains, and siphon structures; visual observations at all storm water discharge locations; outfall sampling from each discharge at least twice for fecal coliform bacteria and a plan to identify and eliminate illegal sewer discharges to stormdrains. The communities have responded to the letter and have taken action to identify and eliminate illegal discharges.

Under the Title 5 Program, the Commonwealth has developed three programs to assist homeowners with wastewater management problems. The Homeowner Septic Loan Program provides low interest loans to homeowners to upgrade systems that will not pass Title 5 inspections. The Comprehensive Community Septic Management Program provides betterment loans to communities to target known or suspected failures or to develop a community-wide management plan. The third option allows homeowners to claim tax credits for septic upgrades. Additional information about the Title 5 Program is available online from the MA DEP website http://www.state.ma.us/dep/brp/wwm/T5pubs.htm#add. In the Neponset River Subwatershed, the towns of Canton, Milton, Sharon, Stoughton, and Walpole have participated in the Comprehensive Community Septic Management Program (Chesebrough 2002).

The Neponset River TMDL, being developed by EPA, MA DEP and other stakeholders, will establish bacterial limits and outline actions to prevent further water quality degradation. Implementation of the

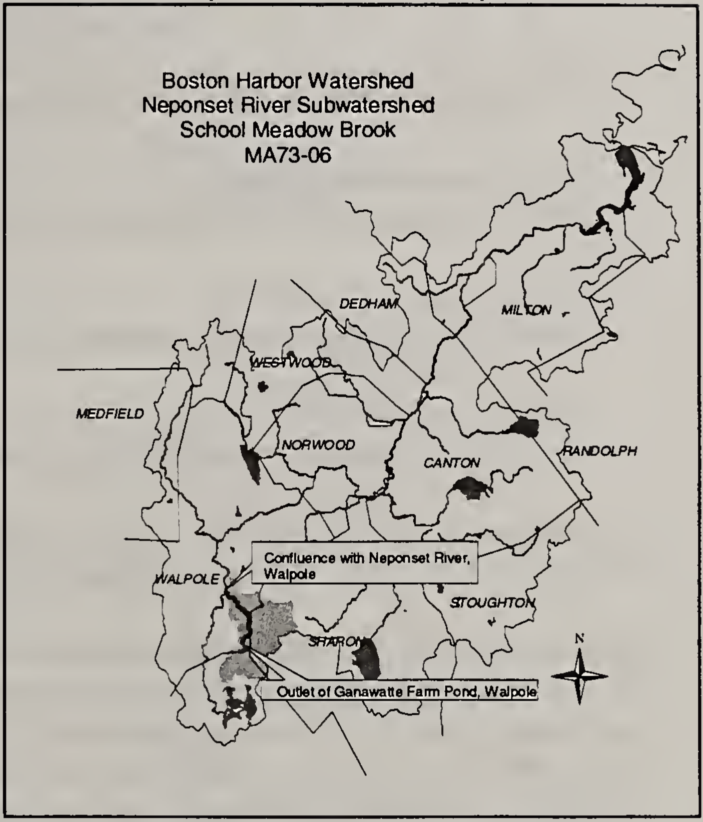
TMDL will occur through a basin wide strategy that includes development of a comprehensive storm water management program, identifying and eliminating illicit discharges, and inspection and upgrade of on-site sewage disposal systems.

RECOMMENDATIONS

- Work with water suppliers, dam managers, and local citizens to minimize the impacts caused by the out of basin transfer of water in the Neponset River Subwatershed.
- Determine the status of the septic system repairs being implanted under the Title 5 program in Canton, Milton, Sharon, Stoughton, and Walpole.

SCHOOL MEADOW BROOK (SEGMENT MA73-06)

Location: Outlet of Ganawatte Farm Pond, Walpole to confluence with Neponset River, Walpole.
Segment Area: 1.7 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	59%
Residential	15%
Open Land	7%

There is one dam located along this segment, Shacounda Dam (Hershman Pond), which is maintained by Sharon Country Day Camp (Ryan, 2001). Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm.

The use assessment for Gannawatte Farm Pond is provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Walpole Sewer & Water Department	3307000	9P31930702	31930701	05,06, 08-10G	1.09 (permitted)* 2.25 (registered)*	3.02

* System-wide withdrawal

NPDES SURFACE DISCHARGE SUMMARY:

Metal Bellows Corp (MA0002305) is permitted to discharge 1,500 GPD via outfall 001 and 20,000 GPD via outfall 002. The seven-day 10-year low flow (7Q10) of the receiving stream (School Meadow Brook) is 0.07 MGD. The permit expired on 18 August 1991 and the facility is currently inactive.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

The Neponset River Watershed Association (NepRWA) conducted bimonthly water quality monitoring in School Meadow Brook from 1997 to 2001 at one station SMB013 – School Meadow Brook at Washington Street. Water quality samples were analyzed for dissolved oxygen, pH, temperature, total suspended solids, ammonia, and total phosphorus (NepRWA 1998, 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (28.3°C).

pH

pH ranged between 6.3 and 7.8 SU (n=10) with only two samples below 6.5 SU.

Total Suspended Solids

TSS concentrations ranged between 0 and 23.35 mg/L (n=14).

Ammonia-Nitrogen (as N)

Ammonia concentrations collected in 1999 and 2000 ranged between 0.003 and 0.060 mg/L (n=9).

Phosphorus (as P)

Total phosphorus concentrations in 1999 and 2000 ranged from 0.003 to 0.072 mg/L (n=9).

Too little instream data (temporal and spatial coverage, no biological indicators) were available to assess the *Aquatic Life Use*: therefore, it is currently not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in School Meadow Brook was conducted by NepRWA in conjunction with water quality monitoring (NepRWA 1998, 1999, 2001a and b). Fecal levels ranged between 8 and 440 cfu/100mL. One of the 15 samples had fecal coliform bacteria counts above 400 cfu/100mL. Samples were collected during both wet and dry weather conditions with both high counts collected during wet weather conditions.

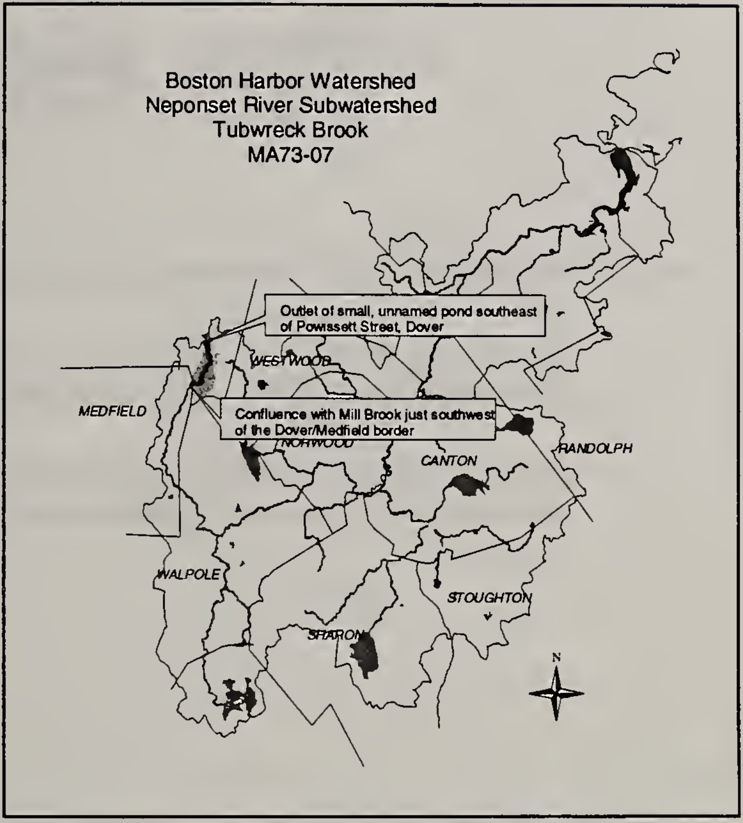
Based on the low fecal coliform bacteria counts during both wet and dry weather conditions over multiple years and land use estimates, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support.

School Meadow Brook (MA73-06) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	NOT ASSESSED				

TUBWRECK BROOK (SEGMENT MA73-07)

Location: Headwaters outlet of small, unnamed pond southeast of Powissett Street, Dover, to the confluence with Mill Brook just southwest of the Dover/Medfield border.
Segment Area: 1.6 miles.
Classification: Class B.


Boston Harbor Watershed
Neponset River Subwatershed
Tubwreck Brook
MA73-07
Outlet of small, unnamed pond southeast of Powissett Street, Dover
Confluence with Mill Brook just southwest of the Dover/Medfield border
MEDFIELD
WESTWOOD
NORWOOD
CANTON
RANDOLPH
WALPOLE
STOUGHTON
SHARON
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	52%
Forest	36%
Agriculture	12%

Tubwreck Brook has been identified by DFWELE as a Coldwater Fishery Resource and has proposed that this segment be reclassified in the SWQS (MassWildlife 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Dover Water Company	3078006	9P231907801		04G 05G	0.14*	0.12

* System-wide withdrawal

The towns of Medfield and Dover withdraw water from wells in the Neponset River Subwatershed to be used in the towns of Medfield and Dover in the Charles River Basin. Since the water is both withdrawn and utilized in the town from which it was pumped from, the WMA registrants are not subject to the Inter-basin Transfer Act.

NPDES SURFACE DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Tubwreck Brook (MA73-07) Use Summary Table

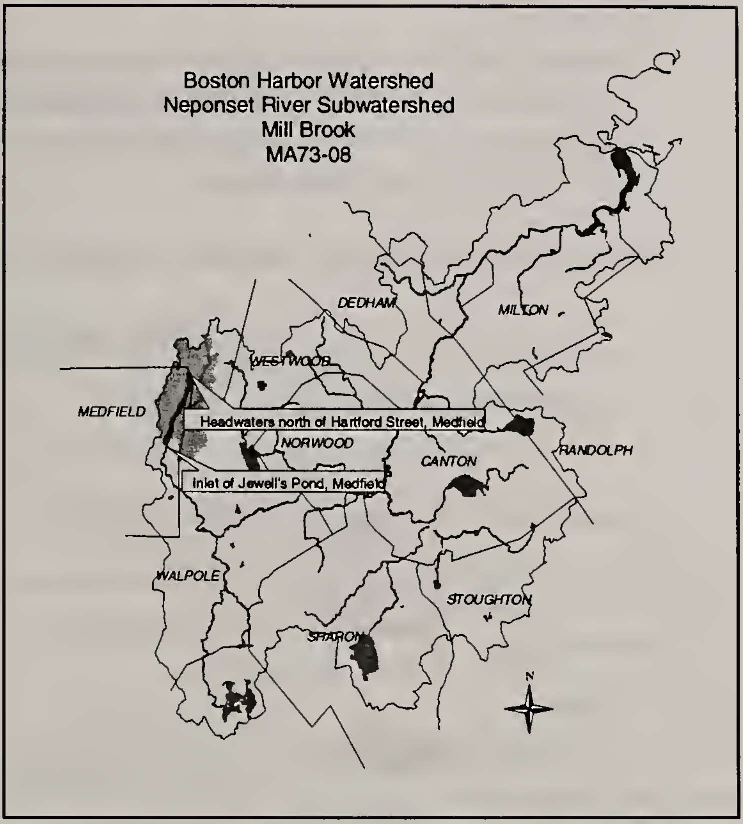
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS TUBWRECK BROOK (MA73-07)

- In the next revision of the Massachusetts Surface Water Quality Standards, consider (in consultation with DFWELE) designating Tubwreck Brook as a Cold Water Fishery.
- Work with the EOEA Watershed Team and NepRWA to collect quality assured water quality and bacteria data to assess the designated uses

MILL BROOK (SEGMENT MA73-08)

Location: From its headwaters north of Hartford Street, Medfield, to inlet of Jewells Pond, Medfield.
Segment Area: 2.3 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	58%
Residential	33%
Agriculture	5%

This segment is on the 1998 303(d) list of impaired waters for unknown causes (MA DEP 1999a).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:
There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DWM conducted benthic macroinvertebrate and fish population sampling at one station on this segment: MB01—Mill Brook, downstream from Millbrook Road, Medfield. The benthic macroinvertebrate community at this station was “slightly impacted” when compared to both the Hawes Brook warm water reference station and the Traphole Brook cold water reference station. The community was dominated by chironomid species typically associated with low flow conditions.

Fish species present in order of abundance included brook trout (*Salvelinus fontinalis*), darter (*Etheostoma olmstedi*), redfin pickerel (*Esox americanus*), chain pickerel (*Esox niger*), and largemouth bass (*Micropterus salmoides*), indicative of a cold-water fishery (Appendix C).

Habitat/Flow

During the 1999 DWM benthic macroinvertebrate survey, the habitat assessment identified extremely low baseflow resulting in much exposed benthos habitat. It was estimated that only about 50% of the stream channel contained water despite the heavy rain received during the previous week (Appendix C). It should be noted that 1999 was a drought year. Average monthly stream flows in June were lower than have been recorded in decades (USGS 5 June 2001).

It should be noted that approximately 95% of the subwatershed is sewered and approximately 42% of the municipal water supply withdrawn in the Neponset River Subwatershed is transferred via the MWRA sewer system to Massachusetts Bay (Kennedy *et al.* 1995).

At station MB01, pollution tolerant benthic and fish species were identified, suggesting that habitat quality (low flow induced habitat constraints), rather than water quality, limits biological potential. Based on a slightly impacted benthic community and low flow conditions, the *Aquatic Life Use* is assessed as partial support

AESTHETICS

During the July 1999 benthic macroinvertebrate survey, DWM also conducted a habitat assessment (Appendix C). No objectionable deposits, odors or colors were noted, although slight sediment deposition from storm water runoff was noted at the Millbrook Road crossing. The stream appeared to be of high aesthetic quality.

Based on the overall high aesthetic quality of the Mill Brook, the *Aesthetics Use* is assessed as support.

Mill Brook (MA73-08) Use Summary Table

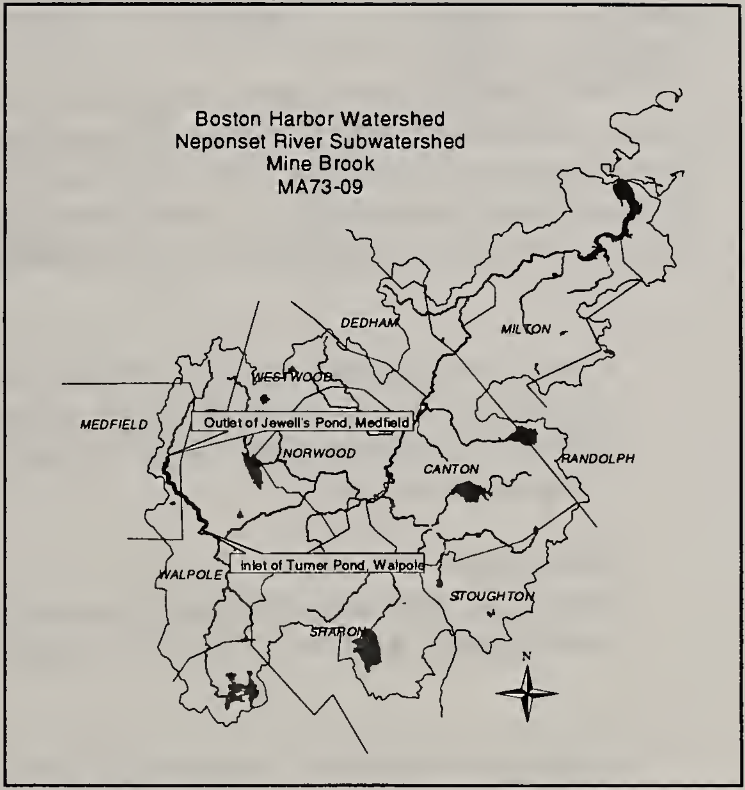
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Unknown, flow alteration		Unknown	Water withdrawal
Fish Consumption		NOT ASSESSED				
Primary Contact		NOT ASSESSED				
Secondary Contact		NOT ASSESSED				
Aesthetics		SUPPORT				

RECOMMENDATIONS MILL BROOK (MA73-08)

- Work with DFWELE to determine if Mill Brook supports a cold water fishery.
- Determine if the low flows identified in 1999 were indicative of drought conditions or were also affected by water use in the subwatershed. It should be noted that since 95% of the subwatershed is sewered the majority of the water withdrawn in the Neponset River Subwatershed is not returned to this subwatershed. It is treated at the MWRA Deer Island facility and discharged to Massachusetts Bay. Additionally, the Dover Water Company has requested an increase in flow and is renovating an existing well. The combination of these two activities may further strain the water resources in the Mill/Mine subwatershed
- Excerpted from Appendix C- 1999 DEP DWM Biomonitoring Technical Memorandum *Technical Memorandum (TM-71/1):*
    - ➢ Outreach efforts should be aimed at consumers to make them aware of the environmental consequences of ever-increasing demands for water, and of measures that can be taken to alleviate existing adverse effects on limited water supplies.
    - ➢ Instream deposition threatens biological integrity at MB01 as well. Sediment inputs—which can be detrimental to trout spawning habitat and epifaunal benthos habitat, and that most likely originate from the Millbrook Road crossing—should be minimized here.
    - ➢ Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

MINE BROOK (SEGMENT MA73-09)

Location: Outlet of Jewells Pond, Medfield, to the inlet of Turner Pond, Walpole.
Segment Area: 3.0 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	55%
Residential	33%
Wetlands	5%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO (MA DEP 1999a). The use assessments for Jewells and Flynns ponds are provided in the Lakes section of this assessment report (Table11). In 2001, DFWELE stocked trout in Mine Brook for the purpose of recreational fishing (DFWELE 15 March 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Medfield Water Department	3175000		31917501	03G 04G	0.92*	0.55
Walpole Water Department	3307000	9P31930702	31930701	02G 03G	1.09 (permitted)* 2.25 (registered)*	3.02

* indicates system-wide withdrawal, all sources are not necessarily within this segment

The towns of Medfield and Dover withdraw water from wells in the Neponset River Subwatershed to be used in the towns of Medfield and Dover in the Charles River Basin. Since the water is both withdrawn and utilized in the town from which it was pumped from, the WMA registrants are not subject to the Inter-basin Transfer Act.

NPDES SURFACE DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Mine Brook at Mill Pond Road (MIB060 1998) and at Elm Street (MIB037 1999 – 2001). Water quality samples were analyzed for DO, temperature, pH, total suspended solids, ammonia, and total phosphorus (NepRWA 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

DO

It should be noted that during DWM's 1994 survey of Mine Brook dissolved oxygen concentrations ranged from 3.2 to 9.6 mg/L with three of the nine samples less than 5.0mg/L. Percent saturations recorded during the 1994 survey ranged from 39.4 to 75.25% with three saturations less than 60% (Kennedy *et al.* 1995).

Temperature

While only three samples were collected during the summer months, all temperature measurements (n=10) were below the SWQS for a Class B waterbody.

pH

pH ranged between 6.1 and 6.5 SU (n=10) with eight samples below 6.5 SU. Land use information and field observations identify this subwatershed as over 50% forested with conifers, which may contribute to low pH.

Total Suspended Solids

TSS concentrations ranged between BDL and 3.3 mg/L (n=19).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.008 and 0.071 mg/L (n=20). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.032 and 0.073 mg/L (n=6).

Although there were no obvious signs of water quality degradation, too little data were available to assess the *Aquatic Life Use* (not assessed).

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in Mine Brook was conducted by NepRWA in conjunction with water quality monitoring at Mill Pond Road (1998) and at Elm Street (1999 – 2001). Sampling was conducted during both wet and dry weather conditions (NepRWA 1999, 2001a and b). Fecal coliform bacteria levels ranged between 1 and 570 cfu/100mL (n=20) with only one sample over 400 cfu/100mLs.

Fecal coliform bacteria counts were low during both wet and dry weather conditions and therefore both the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

NepRWA's water quality sampling of Mine Brook indicated relatively low instream turbidity with good water clarity (NepRWA 1999, 2001a and b). The majority of the land in this subwatershed is forested.

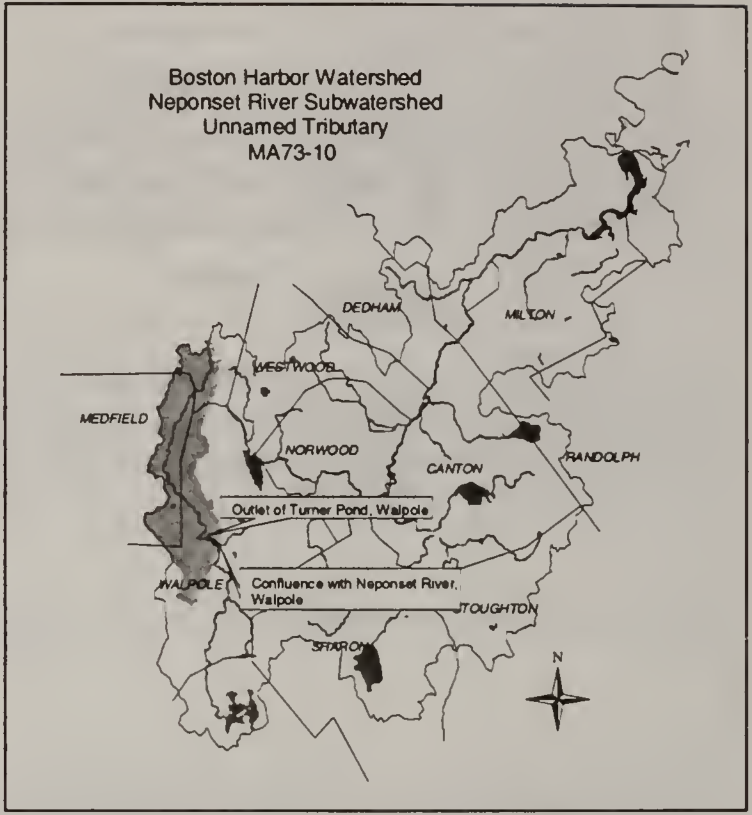
Based on the good water quality, overall high aesthetic quality and land use estimates of Mine Brook the *Aesthetics Use* is assessed as support.

Mine Brook (MA73-09) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

UNNAMED TRIBUTARY (SEGMENT MA73-10)

Location: Outlet Turner Pond in Walpole, to confluence with Neponset River, Walpole.
Segment Area: 1.1 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	51%
Residential	32%
Open land	5%

The use assessment for Turner Pond is provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Walpole Water Department	3307000	9P31930702	31930701	01G 11G	1.09 (permitted)* 2.25 (registered)*	3.02

* indicates system-wide withdrawal, all sources are not necessarily within this segment

NPDES SURFACE DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

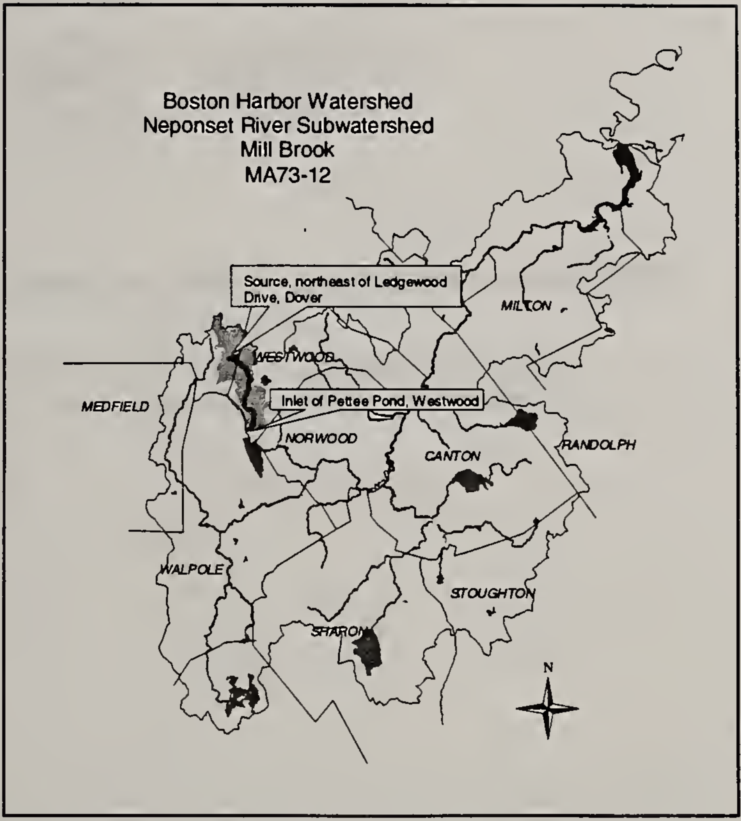
USE ASSESSMENT

Unnamed Tributary (MA73-10) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

MILL BROOK (SEGMENT MA73-12)

Location: Source, northeast of Ledgewood Drive, Dover to inlet of Pettee Pond, Westwood.
Segment Area: 3.1 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	54%
Residential	39%
Agriculture	3%

WMA WATER WITHDRAWAL SUMMARY AND NPDES SURFACE DISCHARGE SUMMARY:
There are no regulated water withdrawals or wastewater discharges in this segment. All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water
NepRWA conducted water quality monitoring at the inlet to Pettee Pond (MLB024) in 2000 and 2001. Water quality samples were analyzed for temperature and pH (NepRWA 2001b).

Temperature
All temperature measurements were below the SWQS (n=2) for a Class B waterbody.

pH
pH measured on 24 May was 7.6 SU and on 26 July was 6.6 SU.

Although there were no obvious signs of water quality degradation, too little instream data (temporal and spatial coverage, no biological indicators) were available to assess the *Aquatic Life Use*: it is currently not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in Mill Brook was conducted by NepRWA in conjunction with water quality monitoring. Fecal coliform concentrations measured 24 cfu/100mL and 36 cfu/100mL on the two sampling dates (NepRWA 2001b).

Too little instream bacteria (temporal and spatial coverage) were available to assess the recreational uses: they are currently not assessed.

Mill Brook (MA73-12) Use Summary Table

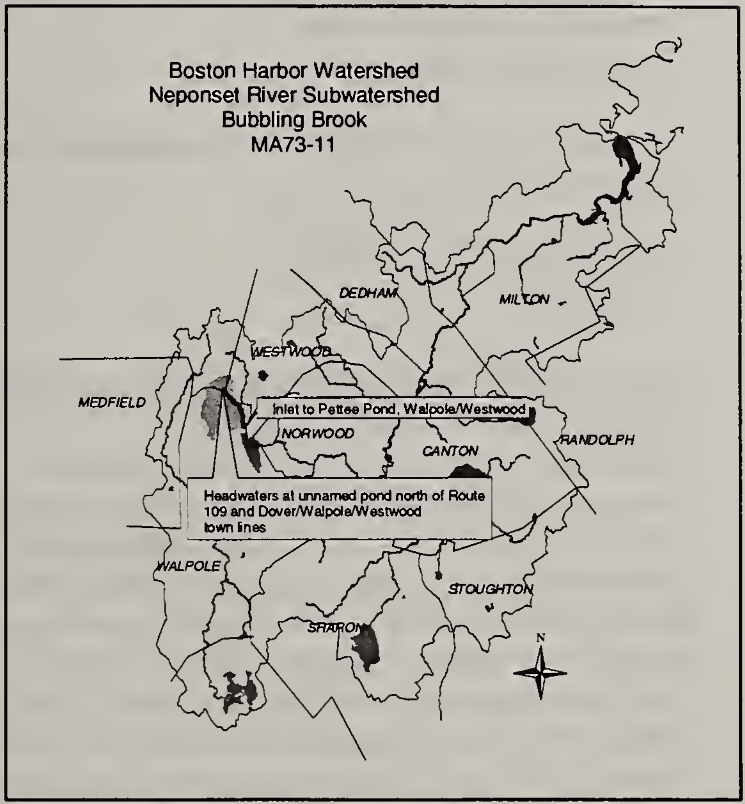
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS MILL BROOK (MA73-12)

- Work with NepRWA, DFWELE, and concerned parties (e.g., North Walpole Fish and Game Club) to determine if Mill Brook supports a cold water fishery.

BUBBLING BROOK (SEGMENT MA73-11)

Location: Headwaters, at a small, unnamed pond north of Route 109 and Dover/Walpole/Westwood town lines, to inlet Pettee Pond, Walpole/Westwood town lines.
Segment Area: 1.1 miles.
Classification: Class B.


Boston Harbor Watershed
Neponset River Subwatershed
Bubbling Brook
MA73-11
DEDHAM
MILTON
WESTWOOD
MEDFIELD
Inlet to Pettee Pond, Walpole/Westwood
NORWOOD
CANTON
RANDOLPH
Headwaters at unnamed pond north of Route 109 and Dover/Walpole/Westwood town lines
WALPOLE
STOUGHTON
SHARON
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	83%
Residential	23%
Agriculture	14%

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Bubbling Brook (MA73-11) Use Summary Table

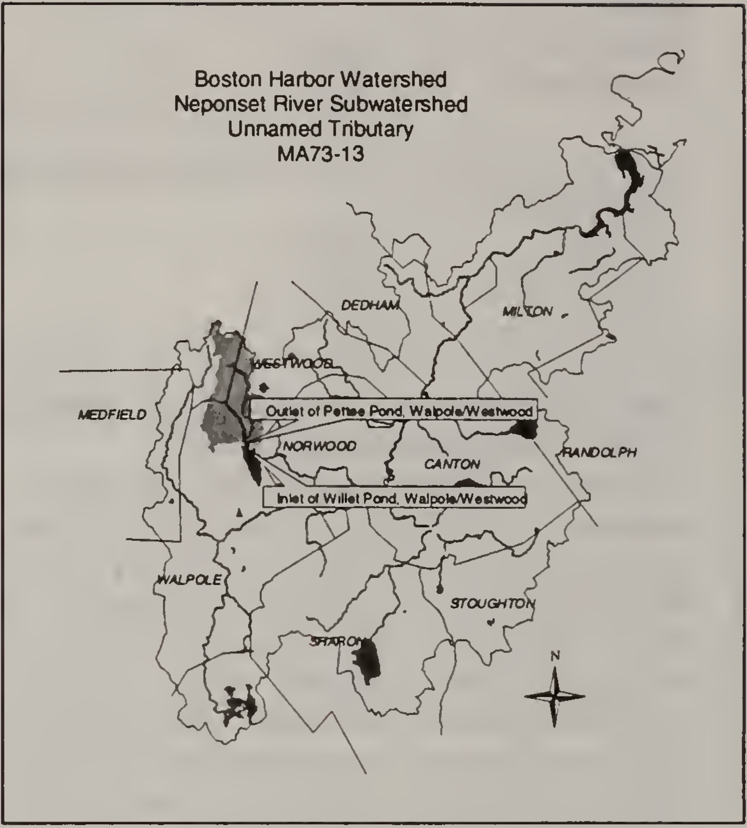
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS BUBBLING BROOK (MA73-11)

- Work with NepRWA, DFWELE, and concerned parties to determine if Bubbling Brook supports a cold water fishery.

UNNAMED TRIBUTARY (SEGMENT MA73-13)

Location: Outlet Pettee Pond Walpole/Westwood to inlet Willet Pond, Walpole/Westwood
Segment Area: 0.03 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	54%
Residential	34%
Agriculture	7%

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

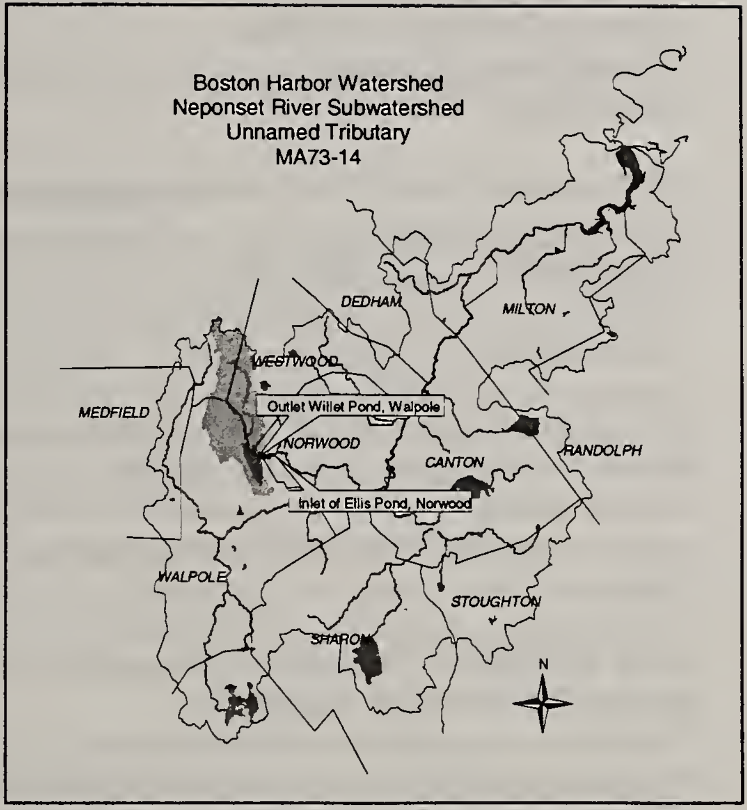
USE ASSESSMENT

Unnamed Tributary (MA73-13) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

UNNAMED TRIBUTARY (SEGMENT MA73-14)

Location: Outlet Willet Pond, Walpole, to inlet Ellis Pond, Norwood
Segment Area: 0.36 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	46 %
Residential	37%
Agriculture	7%

There is one small (four to five foot) dam located along this segment, maintained by the Norwood Fishing Club (NepRWA 2002).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Unnamed Tributary (MA73-14) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

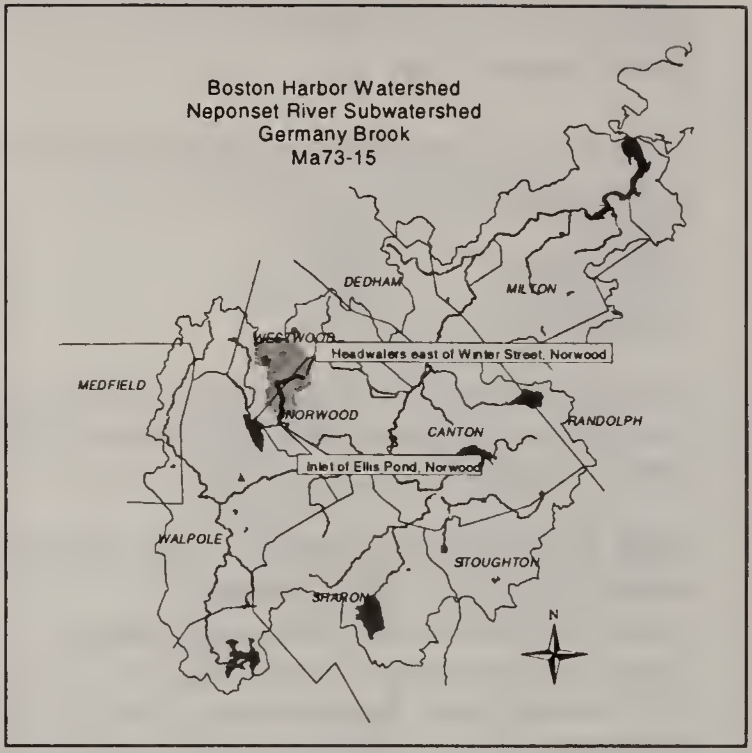
GERMANY BROOK (SEGMENT MA73-15)

Location: Headwaters, east of Winter Street, Norwood, to inlet of Ellis Pond, Norwood.
Segment Area: 2.0 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	58%
Forest	30%
Open Land	10%

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).
The use assessment for Buckmaster Pond is provided in the Lakes section of this assessment report (Table 11).



WMA WATER WITHDRAWAL SUMMARY AND NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

Information on former landfills in the Boston Harbor Watershed is provided in Appendix F. The Norwood Landfill, located in this subwatershed, was partially capped and is currently inactive.

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Germany Brook at Sycamore Drive (GEB008) and at the inlet of Ellis Pond (GEB020) from 1997 to 2001. Water quality samples were analyzed for, dissolved oxygen, temperature, pH, total suspended solids, ammonia, and total phosphorus (NepRWA 1998, 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=24) were below the SWQS for a Class B waterbody.

pH

pH ranged between 6.4 and 8.6 SU (n=22) with one less than 6.5 SU and three samples greater than 8.3.

Total suspended solids

TSS concentrations ranged between BDL and 21.0 mg/L (n=24).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.003 and 0.423 mg/L (n=21). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.028 and 0.112 mg/L (n=21) with two concentrations above 0.10 mg/L.

The *Aquatic Life Use* is assessed as partial support in Germany Brook due to the frequency of pH violations and elevated nutrients.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in Germany Brook was conducted by NepRWA in conjunction with water quality monitoring (NepRWA 1998, 1999, 2001a and b). Samples were collected during wet and dry weather conditions. Fecal coliform bacteria counts ranged from 0 to 29,000 cfu/100mL (n=27). The highest count was recorded during wet weather. During the primary contact recreation season, seven of the 15 samples were greater than 400 cfu/100mL. Additionally, four wet weather samples throughout the years were greater than 4,000 cfu/100mL. Since 1999 there have been no fecal coliform bacteria counts above the dry or wet weather guidance.

Based on the percentage of elevated fecal coliform bacteria counts (33%) during the primary recreation season the *Primary Contact Recreational Use* is assessed as non-support. Bacteria counts exceeded 4,000 cfu/100mL during wet weather conditions therefore the *Secondary Contact Recreational Use* is assessed as partial support.

AESTHETICS

During their bimonthly water quality monitoring in Germany Brook at the inlet of Ellis Pond NepRWA identified a distinct reddish tone to the water (NepRWA 2001b). Additionally, yard waste is being dumped into this brook by local residents (NepRWA 2002). NepRWA's water quality sampling indicated relatively low instream turbidity (NepRWA 1998, 1999, 2000, 2001a and b).

Due to the degraded aesthetic quality and the objectionable color the Aesthetics Use is assessed as partial support.

Germany Brook (MA73-15) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	PARTIAL SUPPORT	pH, nutrients		Unknown	Illicit/faulty sewer connections
Fish Consumption	NOT ASSESSED				
Primary Contact	NON-SUPPORT	Pathogens		Urban runoff/ storm sewers	Illicit/faulty sewer connections
Secondary Contact	PARTIAL SUPPORT	Pathogens		Urban runoff/ storm sewers	Illicit/faulty sewer connections
Aesthetics	PARTIAL SUPPORT	Color, trash and debris		Urban runoff/ storm sewers	Landfill

RECOMMENDATIONS GERMANY BROOK (MA73-15)

- Determine if the Norwood Landfill is leaching into the ground water or surface water of Germany Brook, thereby, contributing to the low pH and reddish floc/water color.

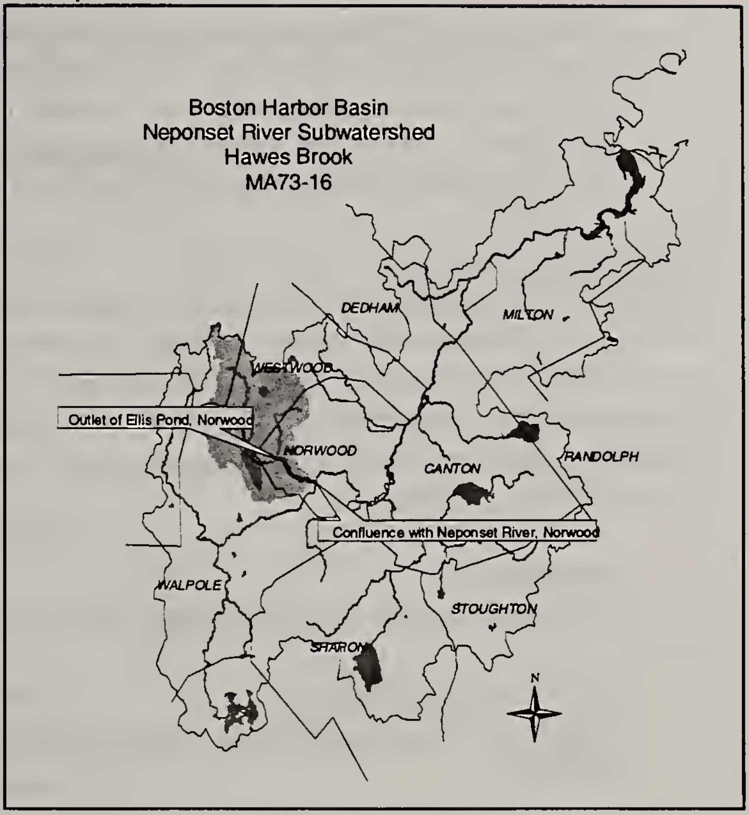
- Investigate sources of elevated nutrients in the Germany Brook subwatershed (e.g., illicit/faulty sewer connections).

- Determine possible sources of elevated levels of fecal coliform bacteria during dry weather including the reduction/elimination of illegal cross connections.

- Implement an outreach program to educate citizens as to proper yard waste disposal practices and the negative impact of excessive nutrients and organic matter on streams.

HAWES BROOK (SEGMENT MA73-16)

Location: Outlet of Ellis Pond, Norwood to confluence with Neponset River, Norwood.
Segment Area: 1.1 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	45%
Forest	37%
Open Land	7%

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

The use assessments for Willis and Ellis ponds are provided in the Lakes section of this assessment report (Table 11).

Ellis Pond Dam is located at the outlet of Ellis Pond in the headwaters of this segment. This dam, rebuilt in 1998, is maintained by the Town of Norwood. The Soap Mill Pond Dam at the Commerce Center (located along this segment) is maintained by the Town of Norwood (NepRWA 2002).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

During extreme rainfall events the Town of Norwood sewer system overflows raw sewage through two known sanitary sewer overflow (SSO) locations along this segment of Hawes Brook (NepRWA 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted a benthic macroinvertebrate survey at the downstream end of this segment, downstream from Washington Street, Norwood (NE09). This station was the warm-water reference station for DWM's 1999 Boston Harbor benthic macroinvertebrate surveys. This station had high habitat quality and was indicative of clean water and "least-impacted" conditions (Appendix C).

Fallfish (*Semotilus corporalis*), American eel (*Anguilla rostrata*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and white sucker (*Catostomus commersoni*) were identified on DWM's 1999 fish population survey (NE09). This fish assemblage was dominated by pond species, which are most likely emigrating from the many upstream impoundments (Appendix C).

Additionally, MassWildlife Northeast District conducted fish population work on this segment in 2000. The seven species collected, in order of dominance, were: fallfish, bluegills, pumpkinseeds, white suckers, American eels, largemouth bass, and yellow bullhead. DFWELE determined that this segment did not support a cold water fishery (Richards 2001).

Habitat

Although the stream was channelized with riprap and concrete block walls, habitat quality was considered good during the July 1999 DEP DWM benthic macroinvertebrate survey. Additionally, some substrate embeddedness (gravel, cobble, and boulder substrates surrounded by fine sediment) and green algae were noted (Appendix C). At the upstream end of this segment, during a DWM fall 2001 field reconnaissance sand deposition was noted in the stream channel.

Chemistry – water

NepRWA collected bimonthly water quality samples at three locations on Hawes Brook between 1997 and 2001: Washington Street (HAB010), Walpole Street (HAB002), and Endean Park, railroad bridge (HAB006). Parameters measured included DO, temperature, total suspended solids, total phosphorus, and ammonia (NepRWA 1998, 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=44) were below the SWQS for a Class B waterbody.

Total Suspended Solids

TSS concentrations ranged between BDL and 64 mg/L (n=59) with only three samples greater than 25 mg/L.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.002 and 0.574 mg/L (n=44). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus levels ranged between 0.021 and 0.87 mg/L (n=46) with fourteen greater than 0.05 mg/L.

The *Aquatic Life Use* is assessed as support based on the high habitat quality associated with the benthic macroinvertebrate reference station (located on this segment). However, Hawes Brook is on "Alert Status" due to the potential negative effects of instream sediment deposition on aquatic life and elevated nutrients.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling (n=78) at their three water quality locations on Hawes Brook (NepRWA 1998, 1999, 2001a and b). Sampling was conducted during wet and dry weather conditions. Fecal coliform levels ranged between 0 and 4,200 cfu/100mL with two counts elevated above 4,000 cfu/100mL (collected during wet weather). During the primary contact recreation season 14 of the 40 samples were above 400 cfu/100mL. Additionally, during extreme rainfall events the Town of Norwood sewer system overflows via two SSOs to this segment of Hawes Brook (NepRWA 2002). It should be noted that the Town of Norwood initiated a Hawes Brook I/I study in Feb. 2001.

Based on the frequency of elevated fecal coliform bacteria counts during the primary contact recreation season, the *Primary Contact Recreational Use* is assessed as non-support. No counts were elevated above 4,000 cfu/100mL during dry weather conditions and the frequency of elevated counts during wet weather was low. Therefore, the *Secondary Contact Recreational Use* is assessed as support.

AESTHETICS

DWM field observations from the fall of 2001 revealed overall high aesthetic quality with good stream cover and a relatively large buffer zone. Localized areas of sedimentation and some trash and debris associated with road runoff were also noted. During their bimonthly water quality monitoring in Hawes Brook, NepRWA identified pipes discharging from the Shaw's plaza, and a strong bitter chemical smell (NepRWA 2001). Additionally, trash and debris have been identified in the streambed near the Commerce Center and the Shaw's Plaza.

Based on the evidence of trash and debris associated with storm water runoff and objectionable odors, Hawes Brook is assessed as partial support for the *Aesthetics Use*.

Hawes Brook (MA73-16) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		SUPPORT*				
Fish Consumption		NOT ASSESSED				
Primary Contact*		NON-SUPPORT	Pathogens		Municipal point source (SSO)	
Secondary Contact		SUPPORT				
Aesthetics		PARTIAL SUPPORT	Trash and debris, odors		Urban runoff/storm sewers	

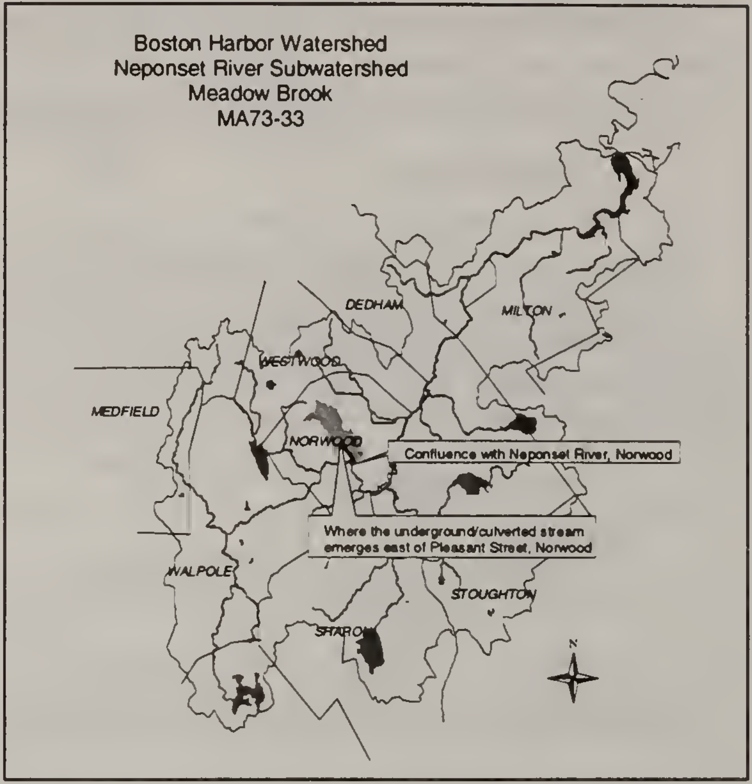
* "Alert Status" issues identified; see *Aquatic Life Use* assessment

RECOMMENDATIONS HAWES BROOK (MA73-16)

- Conduct a shoreline clean up of Hawes Brook and work with local property owners (industrial, state and private), school groups, local citizens and stream teams to reduce future trash inputs.
- Implement an outreach program to educate citizens as to proper yard waste disposal practices and the negative impact of excessive nutrients on streams.
- Work with the Town of Norwood to eliminate the discharge of raw sewage through sanitary sewer overflow (SSO) locations and to minimize the immediate impacts of these current overflows. When available review the CDM report on the Town of Norwood's SSO problems.
- Work with NepRWA to implement their CWMN recommendations for Hawes Brook.

UNNAMED TRIBUTARY (SEGMENT MA73-33)

Location: From where the underground/culverted stream emerges east of Pleasant Street, Norwood to confluence with Neponset River, Norwood. (Locally known as Meadow Brook)
Segment Area: 0.7 miles.
Classification: Class B.


Boston Harbor Watershed
Neponset River Subwatershed
Meadow Brook
MA73-33
DEDHAM
MILTON
WESTWOOD
MEDFIELD
NORWOOD
Confluence with Neponset River, Norwood
Where the underground/culverted stream emerges east of Pleasant Street, Norwood
WALPOLE
STOUGHTON
SHARON
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	70%
Commercial	14%
Open Land	8%

Meadow Brook begins at the Norwood/Westwood town line near Nahatan Street and is culverted under the Town of Norwood for almost its entire length before it emerges from a box culvert southeast of Pleasant Street. It is above ground for 0.7 miles before it confluences with the Neponset River south of Dean Street and west of Rte 1. Fecal coliform bacteria contamination in Meadow Brook has been traced to deteriorating sewer system pipes discharging into underdrains. Norwood has been actively addressing this problem. In the fall of 2000 Norwood completed a 3-year $150,000 flow-monitoring program of the wastewater collection system using flow meters. During the summer of 2001, through its consultant, Norwood attempted to identify direct connections to the underdrain system using smoke testing. Norwood is also currently using MWRA I/I financial assistance to fund a $198,000 project to account for all active sanitary connections that have underdrains in the Meadow Brook watershed by televising all service connections from the main line sewer back towards the building. Additionally, potential sources of exfiltration to the storm drains will be noted. Connections to the sanitary sewer will be confirmed using dye testing. This work will commence in March 2002 (Storrs 2002).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA collected bimonthly water quality samples at two stations on Meadow Brook between 1997 and 1998: Sunnyside Road (MEB001) and Dean Street (MEB006). During 1999 and 2000, NepRWA collected water quality samples only at Sunnyside Road (MEB001). Parameters measured included DO, temperature, total suspended solids, total phosphorus (as P), and ammonia (NepRWA 1998, 1999, 2001a and 2001b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=34) were below the SWQS for a Class B waterbody.

pH

pH ranged between 6 and 8.0 SU with only two less than 6.5 SU (n=35).

Total Suspended Solids

TSS concentrations ranged between BDL and 81 mg/L (n=38) with only three samples greater than 25 mg/L during wet weather conditions.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.082 and 4.746 mg/L (n=37). All measurements were below the acute and chronic criterion for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus levels ranged between 0.05 and 1.15 mg/L (n=35) with 31 greater than 0.1 mg/L.

The *Aquatic Life Use* is assessed as partial support due to elevated nutrients.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling (n=78) at their water quality locations on Meadow Brook (NepRWA 1998, 1999, 2001). Sampling was conducted during wet and dry weather conditions. Fecal coliform levels ranged between 84 and 86,000 cfu/100mL. During the primary contact recreation season counts ranged between 84 and 86,000 cfu/100mL with 25 of the 27 samples above 400 cfu/100mL. Fifteen of the 25 counts above 400 cfu/100mL were collected during dry weather conditions.

Fecal coliform contamination in Meadow Brook has been traced to deteriorating sewer drains discharging into underdrains. Norwood has been actively addressing this problem. In the fall of 2000 Norwood completed a 3-year $150,000 flow-monitoring program of the wastewater collection system using flow meters. During the summer of 2001, through its consultant, Norwood attempted to identify direct connections to the underdrain system using smoke testing. Norwood is also currently using MWRA I/I financial assistance to fund a $198,000 project to account for all active sanitary connections that have underdrains in the Meadow Brook watershed by televising all service connections from the main line sewer back towards the building. Additionally, potential sources of exfiltration to the storm drains will be noted. Connections to the sanitary sewer will be confirmed using dye testing. This work commenced in March 2002 (Storrs 2002).

Based on the frequency of elevated fecal coliform bacteria counts during both wet and dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

AESTHETICS

During DWM fall 2001 reconnaissance, objectionable colors (grey water) and odors (sewage and chlorine) were noted on Meadow Brook. Additionally, a warning sign posted adjacent to Meadow Brook noted that, “water may be contaminated at times”.

Based on the evidence of objectionable odors and color, Meadow Brook is assessed as non- support for the *Aesthetics Use*.

Meadow Brook (MA73-33) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	PARTIAL SUPPORT	Nutrients		Municipal point source (Illicit connections/ underdrains)	
Fish Consumption	NOT ASSESSED				
Primary Contact	NON-SUPPORT	Pathogens		Municipal point source (Illicit connections/ underdrains)	
Secondary Contact	NON-SUPPORT	Pathogens		Municipal point source (Illicit connections/ underdrains)	
Aesthetics	NON-SUPPORT	Taste, odor, and color		Municipal point source (Illicit connections/ underdrains)	

RECOMMENDATIONS MEADOW BROOK (MA73-33)

- Continue to work with the Town of Norwood to identify and eliminate leaking sewers/illicit connections to underdrains.

TRAPHOLE BROOK (SEGMENT MA73-17)

Location: Headwaters west of Everett Street, Sharon, to confluence with Neponset River, Sharon/Norwood.
Segment Area: 3.5 miles.
Classification: Class B.

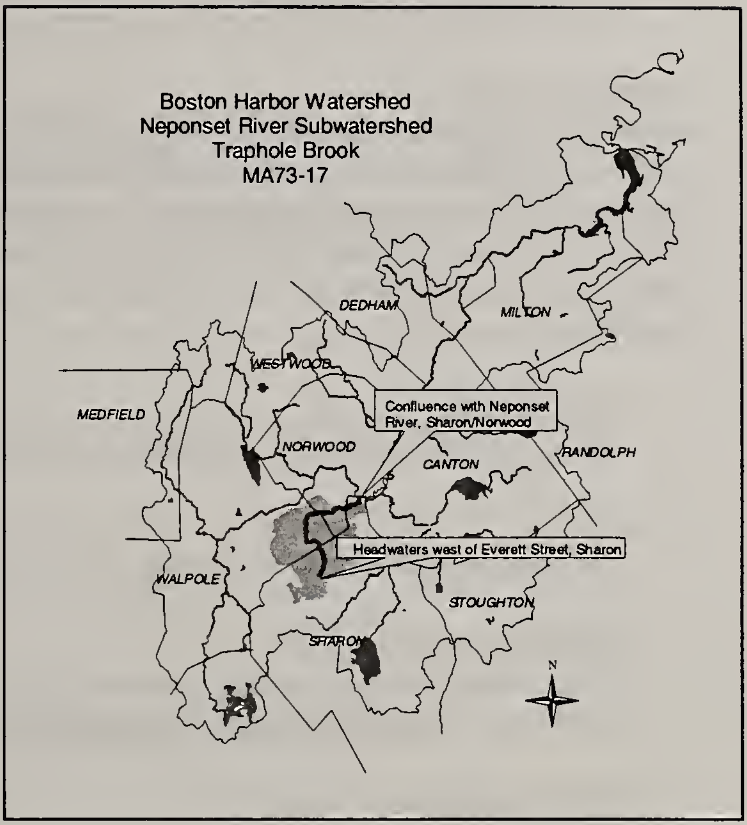
Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	42%
Residential	32%
Open Land	10%

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

This segment of Traphole Brook is within the Fowl Meadow and Ponkapoag Bog ACEC (MA DEM August 2000).

In 2001, DFWELE stocked trout in Traphole Brook for the purpose of recreational fishing (DFWELE 15 March 2001).



WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM sampled the benthic macroinvertebrate community downstream from Coney Street, Walpole at station 5B01 (Appendix C). This station was the cold water reference station for DWM's 1999 Boston Harbor benthic macroinvertebrate surveys. The Traphole Brook benthos assemblage was dominated by highly pollution-sensitive taxa. The balanced trophic structure and optimum community structure further define this as a good reference station.

During DWM's fish population survey, a total of 76 fish were collected in the 5B01 sampling reach. The sample included 29 brown trout (*Salmo trutta*) and 47 brook trout (*Salvelinus fontinalis*).

Additionally, MassWildlife Northeast District conducted fish population work on this segment in 1979, 1986, 1995, and 2000. In 2000, 201 fish were collected; 86 white suckers, 44 redfin pickerel, 37 brown trout, 14 banded sunfish, seven brook trout, and two swamp darters (Richards 2001). These data indicate that this brook supports a cold water fishery.

Habitat

The benthic macroinvertebrate sampling reach was dominated by clear cool riffles with rocky substrates and no signs of sediment deposition noted during sampling. The streambanks were well vegetated with a minimally disturbed riparian zone. Interstate 95 and Route 1 are potential sources or non-point source (NPS) pollution (Appendix C). Sand bars and sedimentation problems have been identified in Traphole Brook by NepRWA and DFWELE. Between January and April 2001, DFWELE interns conducted a habitat assessment of Traphole Brook. They found that storm drains are depositing sand and sediments at various locations throughout the brook (DFWELE 2001b).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Traphole Brook at three stations in 1997 (THB008, THB020 and THB026) and Coney Street (THB020) from 1999 to 2001. Water quality samples were analyzed for dissolved oxygen, temperature, pH, total suspended solids, ammonia, and total phosphorus (as P) (NepRWA 1998, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=20) were below the SWQS for a Class B waterbody.

pH

pH ranged between 6.4 and 8.2 SU (n=18) with one below 6.5 SU.

Total suspended solids

TSS concentrations ranged between BDL and 126 mg/L (n=20). The only sample greater than 25 mg/L was collected during wet weather conditions.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.004 and 0.04 mg/L (n=20). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.003 and 0.146 mg/L (n=19) with three measurements greater than 0.1 mg/L (16%).

Based on the healthy benthic macroinvertebrate community (pollution intolerant) and water chemistry data the *Aquatic Life Use* is assessed as support. Traphole Brook is, however, on “Alert Status” based on the possible negative effects from high levels of phosphorus and sediment deposition.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

DEP OWM’s 1994 assessment of Traphole Brook identified elevated levels of fecal coliform bacteria and chlorides that may be indicative of failing septic systems (Kennedy et al 1995). NepRWA collected fecal coliform bacteria samples at three stations on Traphole Brook in 1997 (THB008, THB020, and THB026) and at one station (THB020) in 1999, 2000 /2001 (NepRWA 1998, 2001a, and 2001b). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts (n=15) during the primary recreation season ranged between 36 and 1,500 cfu/100mL with three counts greater than 400 cfu/100mL, all collected during dry weather on 25 June 1997 at stations THB008, THB020 and THB026.

Since 1997 no fecal coliform bacteria counts have been elevated, therefore the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

Minimal nonpoint sources of pollution were identified during the July 1999 DWM biomonitoring survey (Appendix C). There was no evidence of objectionable conditions (i.e., odors, trash and debris, oils). NepRWA’s water quality sampling indicated relatively low instream turbidity with good water clarity (NepRWA 1999, 2000, 2001). However, as part of their habitat assessment of Traphole Brook in 2001, DFWELE interns identified multiple storm drains discharging milky white substances and orange substances, some with rotten egg odors, in the Coney Street, Union Street, and Sumner Street sections of Traphole Brook (DFWELE 2001b).

Due to good water clarity and the localization and infrequency of trash and debris/objectionable discharges associated with storm events, it is best professional judgment that the *Aesthetics Use* be assessed as support. Traphole Brook is, however, on “Alert Status” due to trash and debris and discharges associated with storm events.

Traphole Brook (MA73-17) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		SUPPORT*				
Fish Consumption		NOT ASSESSED				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics*		SUPPORT*				

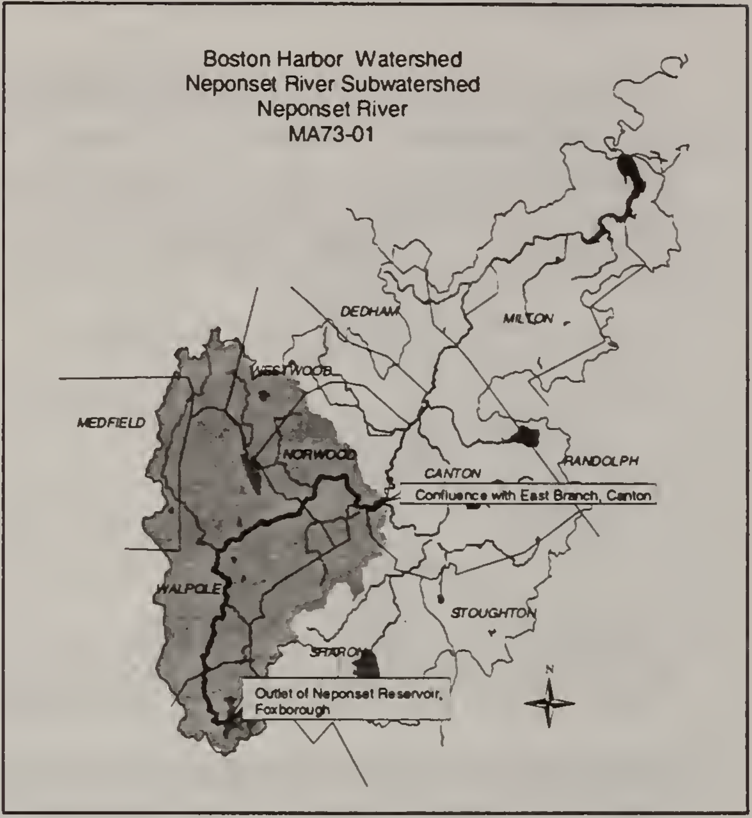
* “Alert Status” issues identified — See *Aquatic Life* and *Aesthetics* use assessments

RECOMMENDATIONS TRAPHOLE BROOK (MA73-17)

- In the next review of the SWQS, recommend that the designation of Traphole Brook be changed to Class B, Cold Water Fishery.
- Work with MassHighways, to reduce road runoff from I95 and Route 1 to Traphole Brook including the implementation of sediment control BMPs.
- Work with NepRWA, DFWELE and MassHighway to identify and eliminate the sources of rotten-egg smelling, colored storm drain discharges to Traphole Brook.
- Continue to track the progress of Norwood’s sewer repair projects. Monitor fecal coliform bacteria levels during wet and dry weather conditions to determine the effectiveness of remediation efforts.

NEPONSET RIVER (SEGMENT MA73-01)

Location: Outlet of Neponset Reservoir, Foxborough to confluence with East Branch, Canton.
Segment Area: 13.7 miles.
Classification: Class B Warm Water Fishery.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	40%
Residential	35%
Open land	8%

This segment of the Neponset River is on the 1998 303(d) list of impaired waters for priority organics, metals, nutrients, siltation, organic enrichment/ low DO, pathogens, total suspended solids, noxious aquatic plants, and turbidity (MA DEP 1999a). The use assessments for Neponset Reservoir, Crackrock, Clark, Memorial, and Bird ponds, as well as Plimpton Pond South, are provided in the Lakes section of this assessment report (Table 11). There are five dams on this segment of the Neponset River: Neponset Reservoir Dam, Crackrock Pond Dam, Neponset River Dam, Stetson Pond Dam, and Bird Pond Dam. This segment of the Neponset River is within the Neponset River Estuary ACEC and the Fowl Meadow and Ponkapoag Bog ACEC (MA DEM August 2000).

USGS collected sediment (September 1999 and August 2000) and white sucker (September 1998 and August 2000) from the Neponset River below Pleasant Street in Norwood (gage 01105000) as part of their Toxics Substances Hydrology Program (an extension of the National Mercury Pilot Study), Urban Land Use Gradient Study (part of the NAWQA program) and the DEP Merrimack Valley Fish Study. The sediment was analyzed for total and methyl mercury, trace elements and organic compounds (Chalmers 2001). Seven-eight fillet composites were analyzed for trace elements and 7-8 whole body composites were analyzed for organic compounds. The data from these analyses are not yet available (Chalmers 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)*	1999 Average Withdrawal (MGD)
Foxborough Water Department	4099000	9P41909901	41909901	01G 02G 03G 12G 13G	0.73 (permitted)* 0.64 (registered)*	Not available
Walpole Sewer and Water Department	3307000	9P31930702	31930701	12G 13G	1.09 (permitted)* 2.25 (registered)*	3.02
Hollingsworth & Vose Company			31930702	Mill Pond	1.02	0.20
Walpole Country Club		9P31930701		Irrigation Pond	0.1	0.15

* System-wide withdrawal

NPDES SURFACE DISCHARGE SUMMARY:

Baker Process (formerly known as Bird Machine Company) (MA00002300) is permitted to discharge NCCW (Temperature limit = 83°F) and storm water (TSS = 50 mg/L) to this segment of the Neponset River. The permit expired October 30, 2000.

Hollingsworth and Vose (MA0004570) is permitted to discharge NCCW and wastewater to the Neponset River. The facility however, is currently tied into the MWRA sewer system and has never used their NPDES permit.

Certainteed (formerly known as Bird Roofing)- Norwood (MA0003531 expires 30 October 2002) is permitted to discharge via four outfalls to this segment of the Neponset River. The facility is permitted to discharge 40,000 GPD of contact cooling water via outfall 001. This outfall has an average monthly temperature limit of 83°F, a daily maximum of 90 °F, a TSS average monthly limit of 40 mg/L, and a daily maximum of 70 mg/L. The whole effluent toxicity limit for outfall 1 is $LC_{50} \geq 100\%$. The facility is also permitted to discharge non-contact cooling water via outfall 002 and treated storm water via 003 and 004.

Factory Mutual Engineering- Norwood (MA0003638) is permitted to discharge sprinkler testing water to the Neponset River subwatershed. The permit is currently out for review (2001). The previous facilities permit (expired 1 April 2001) limits for whole effluent toxicity were $LC_{50} \geq 100\%$ and CNOEC = 100% effluent. TRC concentrations in the effluent (n=10) from April 1998 to March 2001 were between BDL and 0.090 mg/L (TOXTD database).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

USGS conducted biomonitoring on the Neponset River at Norwood (150 m reach downstream from Pleasant St bridge) as part of the NAWQA Northeast Coastal Basins study during 1999 and 2000 (Beaulieu 2001). Their sampling included reach delineation and fish community assessment. Fish species collected included American eel (*A. rostrata*), bluegill (*L. macrochirus*), fallfish (*S. corporalis*), largemouth bass (*M. salmoides*), pumpkinseed (*L. gibbosus*), red breasted sunfish (*L. auritus*), spottail (*Notropis hudsonius*), white sucker (*C.* commersoni), and chain pickerel (*E. niger*). Many species present in this assemblage are macrohabitat generalists (able to survive and prosper in a number of habitat types) typically found in ponds, however, the samples are numerically dominated by organisms that spend their entire life cycle in lotic systems (Maietta 2001). Macroinvertebrate/algal sample collection and habitat assessment data are expected to be available in the spring of 2002.

Toxicity

Effluent

Between April 1998 and March 2001, Factory Mutual Engineering conducted ten whole effluent toxicity tests using the water flea, *C. dubia* and the fathead minnow, *P. promelas*. *C. dubia* whole effluent LC_{50}'s ranged between 16.5 to >100% effluent with four of nine tests < 100% effluent. P. *promelas* whole effluent LC_{50}'s ranged between 17.4 to >100% effluent with four of ten tests < 100% effluent.

Between April 1998 and March 2001, Certainteed/Bird Roofing conducted eight whole effluent toxicity tests using the *C. dubia* and nine using *P. promelas*. The effluent was not acutely toxic to *C. dubia* and. P. *promelas* ($LC_{50} > 100\%$).

Ambient

Factory Mutual Engineering collects water from the Neponset River (at Pleasant Street) for use as a diluent control in their whole effluent toxicity tests. Between April 1998 and March 2001, Factory

Mutual conducted ten tests using *C. dubia* and *P. promelas*. Survival of *C. dubia* and *P. promelas* exposed (48 hr) to the river water was good (not less than 95%).

Certainteed/Bird Roofing collects water upstream from their outfall on the Neponset River for use as dilution water in their whole effluent toxicity tests. Between July 1999 and March 2001, Certainteed/Bird Roofing conducted four tests using *C. dubia* and five tests using *P. promelas*. Survival of *C. dubia* and *P. promelas* exposed (48 hr) to the river water was good (100%).

Habitat/Flow

Flow in the Neponset River at Norwood, (gage #01105000) was recorded by USGS as part of the NAWQA program. Discharges ranged from 4.4 to 206 cfs between October 1998 and September 2000 (Socolow *et al.* 1999 and Socolow *et al.* 2000). The sixty-year average discharge at this gage is 56.1cfs. It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

Downstream from Crackrock Pond the Neponset River historically flowed under Foxborough Raceway into the raceway infield where it was above ground for approximately ¼ mile. Recently, the River has been day-lighted and rerouted next to the railroad tracks away from the new Gillette Stadium. As of winter 2001 the construction was still underway.

Chemistry – water

NepRWA collected bimonthly water quality samples at six stations on this segment of the Neponset River between 1997 and 2001:

NER002- Neponset River at outlet of Crackrock Pond (1999-2001)
NER021- Neponset River at Summer Street (1998)
NER040- Neponset River at South Street (1999-2001)
NER075- Neponset River at Hollingsworth and Vose Dam (1997-2001)
NER080- Neponset River at Pleasant Street Bridge (1999-2001)
NER095- Neponset River at Neponset Street (1997)

Parameters measured included DO, temperature, pH, TSS, ammonia, and total phosphorus (as P). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

As part of the NAWQA program, USGS sampled the Neponset River at their streamflow gage in Norwood. Monthly samples for DO, temperature, pH, ammonia-nitrogen (as N), and total phosphorus (as P) were collected between October 1999 and September 2000 (Socolow *et al.* 1999 and Socolow *et al.* 2000).

Factory Mutual Engineering collects water from the Neponset River (at Pleasant St) for use as a diluent control in their whole effluent toxicity tests. Ambient chemistry analyses included: pH, TSS, ammonia, and hardness (TOXTD database).

DO

NAWQA dissolved oxygen concentrations ranged from 6.6 to 15.2 mg/L (n=28). No measurements were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature measurements (n=49) were below the SWQS for a Class B waterbody.

pH

At NepRWA's four stations, pH ranged between 6.6 and 8.4 SU (n=53). pH at the USGS gage in Norwood ranged from 6.8 to 7.6 SU (n=26). Measurements of pH in the Neponset River at Pleasant Street reported by Factory Mutual ranged between 6.1 and 7.5 SU (n=10). Measurements of pH in the Neponset River reported by Bird Roofing ranged between 6.5 and 7.8 SU (n=8). Of the 79 total pH measurements, only one was below 6.5 SU.

Total Suspended Solids

NepRWA reported TSS concentrations (n=57) ranging from BDL to 35 mg/L with only one number greater than 25 mg/L (wet weather).

Ammonia-Nitrogen (as N)

Ammonia concentrations reported by NepRWA ranged from BDL to 0.295 mg/L (n=58). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Ammonia-nitrogen (as N) concentrations reported by NAWQA ranged from BDL to 0.184 mg/L (n=28). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Ammonia concentrations reported by Bird Roofing and Factory Mutual were within the ranges reported by NepRWA and NAWQA and below the acute and chronic water quality criteria.

Total Phosphorus (as P)

NepRWA total phosphorus concentrations ranged from 0.01 mg/L to 0.41 mg/L (n=56) with six samples greater than 0.1 mg/L. NAWQA total phosphorus concentrations ranged from 0.014 mg/L to 0.139 mg/L (n=28).

Hardness

Hardness reported by Factory Mutual ranged between 24 and 58 mg/L (n=10).

Chemistry- sediment

As part of the DEP 1994 survey, sediment chemical analyses were conducted at three stations (Crackrock Pond, Bird Pond and at Route 1 in Norwood) on this segment of the Neponset River. At Crackrock Pond several analytes (TP, TKN, Cd, Cr, Cu, Ni and Hg) exceeded the S-EL threshold, while lead exceeded the L-EL. At Bird Pond however, cadmium was not detected nor was it detected in the Neponset River sediments. Concentrations of Cu, As and Pb were greater than the S-ELs, while, Cr, Fe, and Mn were greater than the L-ELs. At the Route 1 station only Cd and Pd were greater than the L-ELs. It should be noted that the MDL for cadmium in 1994 was greater than the L-EL (Kennedy *et al.* 1995).

The headwaters of the Neponset River, Neponset Reservoir, received the treated process wastewater discharge from Foxborough Company for many years. This discharge has lead to the heavy metal contamination of the sediments in the reservoir. The May 1998 Phase I Investigation Report of the Neponset Reservoir found that cadmium and a number of other metals in sediments exceeded the Massachusetts Contingency Plan Stage I screening levels that are used to judge if there is potential for exposure (Menzie-Cura & Associates 2001). Because of these findings a Stage II Risk Characterization was performed. DEP approved the Phase II Comprehensive Site Assessment and environmental risk characterization in May of 1998. Through this work the specific constituents of concern were identified (metals, cyanide and volatile organic chemicals). Through four assessment endpoints and associated measurement endpoints the following conclusions were made:

- There was no physical evidence of a continuing release of oil and/or hazardous material to the surface waters which significantly affects Environmental Receptors
- There is no evidence of biologically significant harm associated with current or future exposure of wildlife, fish, shellfish or other aquatic biota to oil and/or hazardous material at or from the site.
- Concentrations of oil and/or hazardous material at or from the disposal site do not and are not likely to exceed any applicable environmental standards
- There is no indication of the potential for biologically significant harm either currently or in the future to Environmental Receptors considering their potential exposures to oil and/or hazardous material and the toxicity of oil and/or hazardous material

Currently, the Neponset Reservoir (DEP Site #4-0011387) is a Tier 1A, Phase II hazardous waste site.

The *Aquatic Life Use* for this segment of the Neponset River is assessed as support based on water quality, biology and ambient survival data from multiple stations. However, one-mile downstream of the Factory Mutual discharge is threatened due to whole effluent toxicity. This segment of the Neponset River is on "Alert Status" due to the possible negative impacts caused by elevated levels of total phosphorus and the historically high contaminant levels in the sediments of Neponset Reservoir and Crackrock Pond.

FISH CONSUMPTION

MDPH issued a fish consumption advisory for the Neponset River from the Hollingsworth and Vose Dam to the Tilestone Dam due to elevated levels of PCBs in fish tissue (MDPH 2001a). The MDPH advisory recommends the following:

1. Children younger than 12-years, pregnant women, and nursing mothers, should not consume any brown bullhead from the Neponset River.
2. The general public should limit consumption of brown bullhead from the Neponset River to two meals per month.

Based on the MDPH site-specific fish consumption advisory, from the Hollingsworth and Vose Dam downstream 4.70 miles, this segment is assessed as non-support for the *Fish Consumption Use.* The remaining 9.00 miles are currently not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Between 1997 and 2001 NepRWA collected 68 fecal coliform bacteria samples at the six water quality stations along this segment of the Neponset River (NepRWA 1998, 1999, and 2001). Counts ranged from 0 to 2,300 cfu/100mL during both wet and dry weather conditions. Thirty samples were collected during the primary contact season (range 6 to 2,300 cfu/100mL) with three elevated above 400 cfu/100mL (one wet and two dry, all prior to 1999).

Since 1998, fecal coliform bacteria levels have not been elevated during dry weather conditions. Based on overall low bacteria counts the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

NepRWA's water quality sampling indicated relatively low instream turbidity. Trash and debris, however, from road and storm water runoff were also identified from multiple locations (NepRWA 1998, 1999, and 2001). DWM field observations from the fall of 2001 revealed clumping mats of algae in Crackrock Pond (headwaters of this segment of the Neponset River).

The *Aesthetics Use* is assessed support for this segment of the Neponset River. However, this segment is on "Alert Status" due to trash and debris associated with urban runoff.

Neponset River (MA73-01) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		SUPPORT*				
Fish Consumption		NON-SUPPORT 4.7 miles NOT ASSESSED 9.0 miles	PCBs		Unknown	
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics*		SUPPORT*				

*"Alert Status" issues identified- See *Aquatic Life* and *Aesthetics* use assessments

RECOMMENDATIONS NEPONSET RIVER (MA73-01)

- Factory Mutual (MA0005304) should continue to collect water from the Neponset River upstream of their discharge to use as dilution water in their whole effluent toxicity tests. If the river water does not meet the control test acceptability criteria (e.g., survival > 80% at 7-day), then Neponset River water must still be utilized as a test control and not as diluent. If toxicity test results continue to violate permit limits (frequency and severity of violations considered), a toxicity identification and reduction evaluation should be conducted.

- The DWM 1994 benthic macroinvertebrate surveys identified a moderately impacted benthic community. Conduct a biological survey on the Neponset River to determine if the improving water quality has made an impact on the biota.

- Continue to review the Neponset Reservoir clean up data and conduct additional sediment analyses (metals and toxicity) to determine if the historical contamination is currently impacting water quality and the biota downstream from the reservoir

- Continue to monitor pathogen levels in the Neponset River (including Norwood) to determine if the ongoing sewer and septic system repair projects are effective in reducing pathogen levels during wet and dry weather conditions.

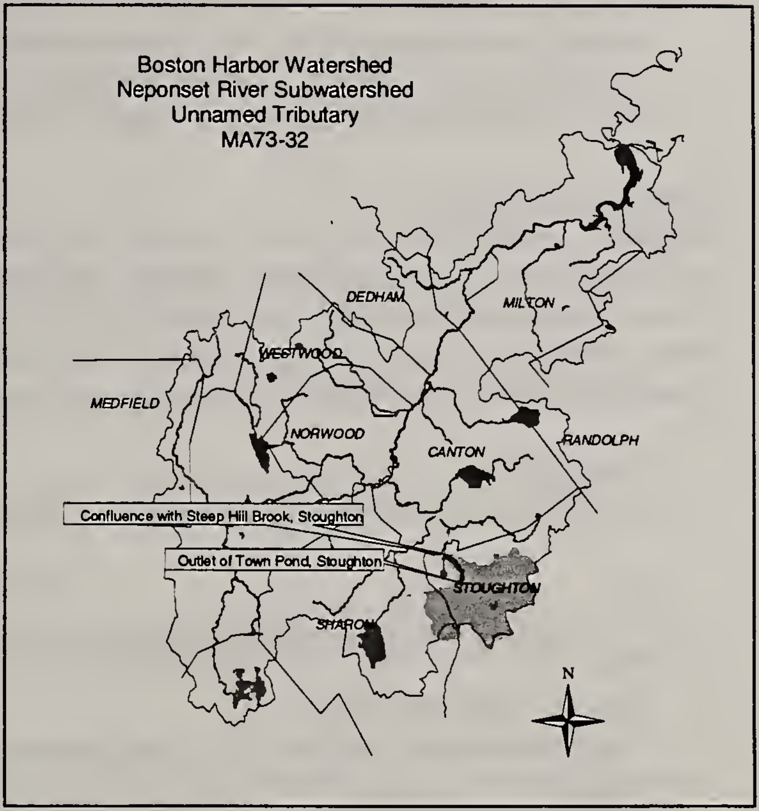
UNNAMED TRIBUTARY (SEGMENT MA73-32)

Location: From the outlet of Town Pond, Stoughton, to the confluence with Steep Hill Brook, Stoughton. (Locally known as Steep Hill Brook)
Segment Area: 1.0 mile.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	55%
Forest	22%
Open Land	8%

The use assessment for Town Pond is provided in the Lakes section of this assessment report (Table 11).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Stoughton DPW-Water Division	4285000	9P41928501	41928502	01G 02G 03G 04G 05G 06G	0.13 (permitted)* 1.08 (registered)*	Not available

*System-wide withdrawal

NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999 DEP DWM conducted benthic macroinvertebrate and fish population studies at station SB01, downstream from Central Street, Stoughton. SB01 was "slightly impacted" when compared to both the warm (NE09) and cold (5B01) water reference stations. The dominant species were filter-feeding caddisflies, which indicates a large amount of suspended fine particulate organic matter in this portion of the stream (Appendix C).

The fish species present during the 1999 DWM biological survey, in order of abundance, included pumpkinseed (*L. gibbosus*), largemouth bass (*M. salmoides*), white sucker (*C. commersoni*), chain pickerel (*E. niger*), and American eel (*A. rostrata*) (Appendix C).

Habitat

As part of DEP DWM's 1999 benthic macroinvertebrate and fish population studies at station SB01 a habitat survey was conducted (Appendix C). Optimal benthic macroinvertebrate habitat was identified in the sampling reach; however, a small section of the streambank was channelized and some evidence of streambank erosion was noted.

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in an unnamed tributary (locally known as Steep Hill Brook) at Central and West Streets, SHB021 from 1999 to 2001 (NepRWA 1999 and 2001a and b). Water quality samples were analyzed for DO, temperature, pH, total suspended solids, ammonia, and total phosphorus (as P). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=6) were below the SWQS for a Class B waterbody.

pH

pH readings ranged between 6.4 and 7.0 SU (n=7) with two measurements less than 6.5 SU.

Total Suspended Solids

TSS concentrations (n=10) ranged between BDL and 26 mg/L with only one sample greater than 25 mg/L.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.030 and 0.122 mg/L (n=11). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.02 and 0.092 mg/L (n=11) with five samples greater than 0.05 mg/L

Based on the slightly degraded water quality (elevated nutrients, and low pH) and a slightly impacted benthic community, the *Aquatic Life Use* is assessed as partial support.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in this unnamed tributary was conducted by NepRWA in conjunction with water quality monitoring (NepRWA 1999 and 2001a and b). Fecal coliform levels ranged between 6 and 310 cfu/100mL (n=11). Samples were collected during both wet and dry weather sampling conditions.

The *Primary* and *Secondary Contact Recreational* uses are assessed as support for this mile long segment based on the low fecal coliform bacteria counts.

AESTHETICS

During the July 1999 DWM biology survey localized trash and debris, probably originating from the adjacent shopping area parking lot, was identified (Appendix C). There was no additional evidence of objectionable conditions (odors, and/or oils). NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity (NepRWA 1999 and 2001a and b).

Based on the high aesthetic quality of this brook the *Aesthetics Use* is assessed as support.

Unnamed Tributary (MA73-32) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Unknown, nutrients, pH		Unknown	
Fish Consumption		NOT ASSESSED				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

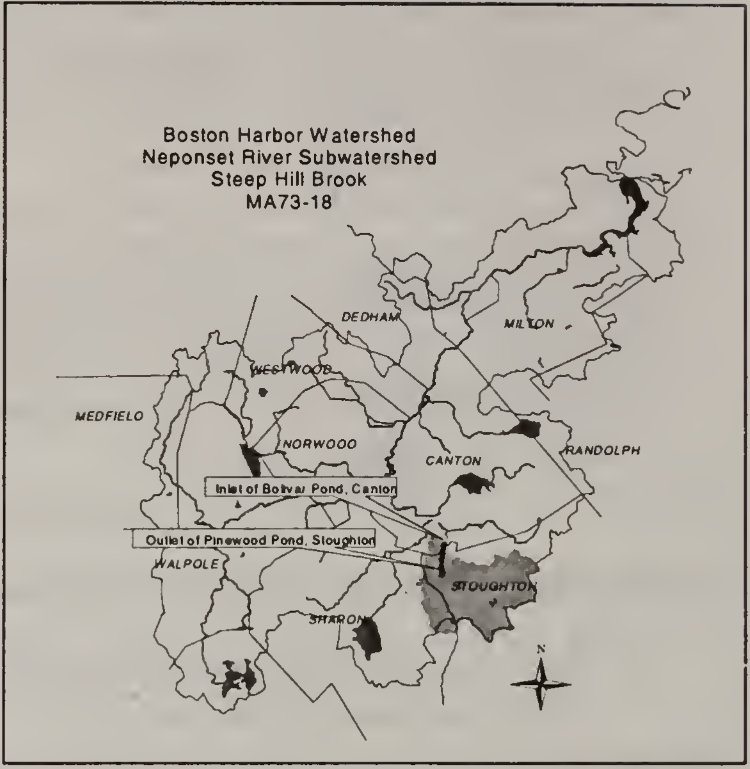
RECOMMENDATIONS UNNAMED TRIBUTARY (MA73-32)

- Work with NepRWA and local residents to remove trash and debris and prevent future dumping from the shopping area parking lot.

- Conduct citizen outreach education workshops to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious surfaces, and erosion controls).

STEEP HILL BROOK (SEGMENT MA73-18)

Location: Outlet of Pinewood Pond, Stoughton, to the inlet of Bolivar Pond, Canton
Segment Area: 1.0 mile.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	56%
Forest	23%
Open Land	8%

The use assessments for Pinewood and Woods ponds are provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Stoughton DPW-Water Division	4285000	9P41928501	41928502	08G	0.13 (permitted)* 1.08 (registered)*	Not available

*System-wide withdrawal

NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Steep Hill Brook (MA73-18) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS STEEP HILL BROOK (MA73-18)

- Work with NepRWA and local residents to remove trash and debris and prevent future dumping in the Steep Hill Brook Subwatershed.
- Conduct citizen outreach education workshops to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious surfaces, and erosion controls).

BEAVER MEADOW BROOK (SEGMENT MA73-20)

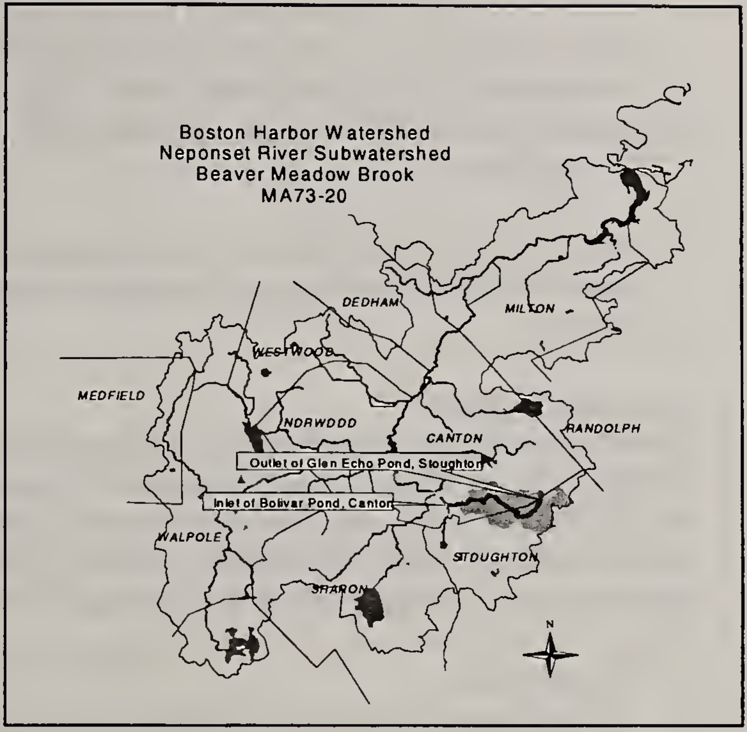
Location: Outlet of Glenn Echo Pond, Stoughton, to the inlet of Bolivar Pond, Canton.
Segment Area: 3.3 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	45%
Residential	31%
Industrial	11%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO and pathogens (MA DEP 1999a).

The use assessment of Glen Echo and Bolivar ponds are provided in the Lakes section of this assessment report (Table 11).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)*	1999 Average Withdrawal (MGD)
Town of Canton	3050000			03G	1.0	0.62

* System-wide withdrawal

NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999 DEP DWM conducted benthic macroinvertebrate and fish population studies at station BM01, downstream from Pine Street, Canton (Appendix C). Station BM01 was 88% comparable to the warm water reference station NE09 (i.e., "non-impacted"). When compared to the cold water reference station, the BM01 benthic community was only 63% comparable (i.e., "slightly impacted"). However, this slight impact was the result of the trophic structure, which was skewed towards filter-feeders.

Fish species present in order of abundance included brown bullhead (*A. nebulosis*), white sucker (*C. commersoni*), largemouth bass (*M. salmoides*), American eel (*A. rostrata*), pumpkinseed (*L. gibbosus*), darter (*E. olmstedi*), yellow perch (*P. flavescens*), redfin pickerel (*E. americanus*), and golden shiner (*N. crysoleucas*).

Habitat/Flow

As part of DEP DWM's 1999 benthic macroinvertebrate and fish population studies at station BM01 a habitat survey was conducted (Appendix C). Reduced baseflow was noted during spring reconnaissance. During the July sampling event baseflow had returned to normal. The increased flows were probably associated with recent rain events. Optimal fish and benthic macroinvertebrate habitat was identified in the sampling reach; however, a very small section of the streambank was channelized.

NepRWA has identified low baseflows in Beaver Meadow Brook and has noted houses and an apartment complex pumping water directly out of the brook to water yards and gardens (NepRWA 2002).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Beaver Meadow Brook at Pine Street (BMB026) from 1999 to 2001 (NepRWA 1999 and 2001a and b). Water quality samples were analyzed for DO, temperature, pH, total suspended solids, ammonia, and total phosphorus. Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements (n=6) were below the SWQS for a Class B waterbody.

pH

pH ranged between 6.6 and 7.3 SU (n=6).

Total Suspended Solids

TSS concentrations ranged between BDL and 8 mg/L (n=10).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.020 and 0.108 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.031 and 0.07 mg/L (n=10) with four samples greater than 0.05 mg/L.

Based on the overall high water quality (temperature, pH, and TSS), the non- to slightly impacted benthic community and land-use information, the *Aquatic Life Use* is assessed as support for the entire 3.3 miles of Beaver Meadow Brook.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling (n=10) in Beaver Meadow Brook in conjunction with water quality monitoring between 1999 and 2001 (NepRWA 1999 and 2001a and b). Fecal coliform bacteria counts ranged between 3 and 970 cfu/100mL. During the primary contact season (n=6), bacteria counts ranged between 108-950 cfu/100ml, with only one count greater than 400 cfu/100mL. This one high count was collected during wet weather.

Based on the low fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

During the July 1999 DWM biology survey localized trash and debris, probably originating from the adjacent apartment complex, was identified (Appendix C). During the DEP DWM 1999 survey the water column appeared turbid, however, on the day preceding sampling, over half an inch of rain fell across the subwatershed. NepRWA's water quality sampling data indicated relatively low instream turbidity (NepRWA 1999 and 2001a and b). Trash and debris from road and storm water runoff were also identified (NepRWA 2002).

The *Aesthetics Use* is assessed as support. However, this segment is on “Alert Status” due to trash and debris from urban runoff.

Beaver Meadow Brook (MA73-20) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	SUPPORT				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics*	SUPPORT*				

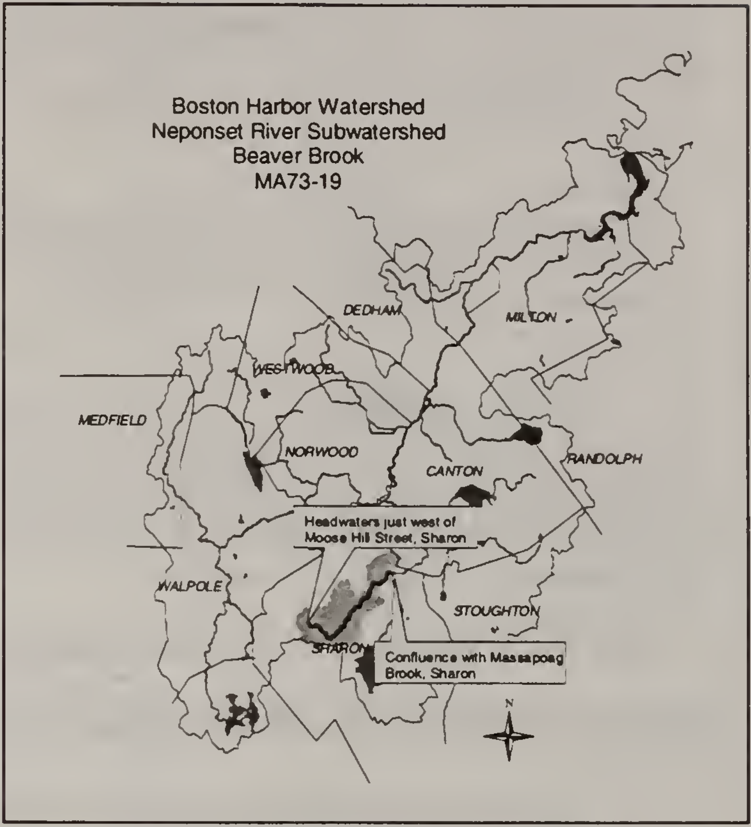
* ”Alert Status” issues identified –See *Aesthetics Use* Assessment

RECOMMENDATIONS BEAVER MEADOW BROOK (MA73-20)

- Work with NepRWA to conduct a stream clean up to remove trash and debris in the Beaver Meadow Brook Subwatershed.
- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e. yard waste disposal practices, reduction of impervious services, and erosion controls).
- Investigate possible sources of reduced baseflow in Beaver Meadow Brook including the impacts of water supplies, non-permitted withdrawals, and sewer infiltration and inflow.

BEAVER BROOK (SEGMENT MA73-19)

Location: Headwaters just west of Moose Hill Street, Sharon, through Sawmill Pond, to confluence with Massapoag Brook, Sharon.
Segment Area: 3.5 miles.
Classification: Class B.


Boston Harbor Watershed
Neponset River Subwatershed
Beaver Brook
MA73-19
DEDHAM
MILTON
WESTWOOD
MEDFIELD
NORWOOD
CANTON
RANDOLPH
Headwaters just west of Moose Hill Street, Sharon
WALPOLE
STOUGHTON
SHARON
Confluence with Massapoag Brook, Sharon
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	58 %
Residential	27%
Open Land	7%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO (MA DEP 1999a).

In 2001, DFWELE stocked trout in Beaver Brook for the purpose of recreational fishing (DFWELE 15 March 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Sharon Water Department	4266000	9P41926601	41926603	01G 02G 03G	0.42 permitted 0.55 registered	Not available

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted benthic macroinvertebrate sampling at BB01, downstream from Mascwonicut Street, Sharon (Appendix C). The benthos assemblage was 82% comparable to the warm-water reference community at NE09 (i.e., "non/slightly impacted"). The taxa richness was the highest of all the Boston Harbor biomonitoring stations suggesting good diversity and a community dominated by pollution-sensitive species. When compared to the cold water reference station, BB01 was "slightly impacted". However, several of the benthic macroinvertebrate metrics scored better than, or as good as, the cold water reference station.

The fish community at the Beaver Brook sampling location contained a total of only four fish: brown trout (*S. trutta*), white sucker (*C. commersoni*), largemouth bass (*M. salmoides*), and redfin pickerel (*E. americanus*). It is unclear as to why fish were largely absent from this sampling reach (Appendix C).

Habitat

As part of DEP DWM's 1999 benthic macroinvertebrate and fish population studies at station BB01 a habitat survey was conducted (Appendix C). Optimal benthic macroinvertebrate and fish habitat was identified in the sampling reach. Several midge species in the benthic samples, however, were considered tolerant of low flow conditions. Additionally, it is possible that episodic low flow events may be responsible for the low numbers of fish due to reduced/impaired habitat conditions.

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Beaver Brook at Upland Street (BEB013) from 1999 to 2001(NepRWA 2001a and b). Water quality samples were analyzed for dissolved oxygen, temperature, pH, total suspended solids, ammonia, and total phosphorus (as P). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=6).

pH

pH ranged between 6.5 and 7.0 SU (n=6).

Total suspended solids

TSS concentrations ranged between BDL and 4 mg/L (n=10).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.005 and 0.032 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.01 and 0.063 mg/L with two samples greater than 0.05 mg/L (n=10).

Beaver Brook is assessed as partial support based on a slightly impacted benthic community, low fish densities and suspected low flows (despite excellent fish habitat).

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling (n=10) in Beaver Brook was conducted by NepRWA in conjunction with water quality monitoring between 1999 and 2001 (NepRWA 2001a and b). Fecal coliform bacteria counts ranged between 3 and 140 cfu/100mL. Samples were collected during both wet and dry weather conditions. During the primary contact season, bacteria counts ranged between 4 and 140cfu/100mL (n=6). It should be noted that the Town of Sharon is served entirely by on-site septic systems.

The *Primary* and *Secondary Contact Recreational* uses are assessed as support based on low fecal coliform bacteria counts during both wet and dry weather.

AESTHETICS

Minimal nonpoint sources of pollution (railroad tracks and road crossings) were identified during the July 1999 DWM biology survey (Appendix C). There was no evidence of objectionable conditions (i.e., odors, trash and debris, oils). NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity (NepRWA 2001a and b).

Based on the high aesthetic quality of Beaver Brook the *Aesthetics Use* is assessed as support.

Beaver Brook (MA73-19) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Unknown	Low flow	Unknown	
Fish Consumption		NOT ASSESSED				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

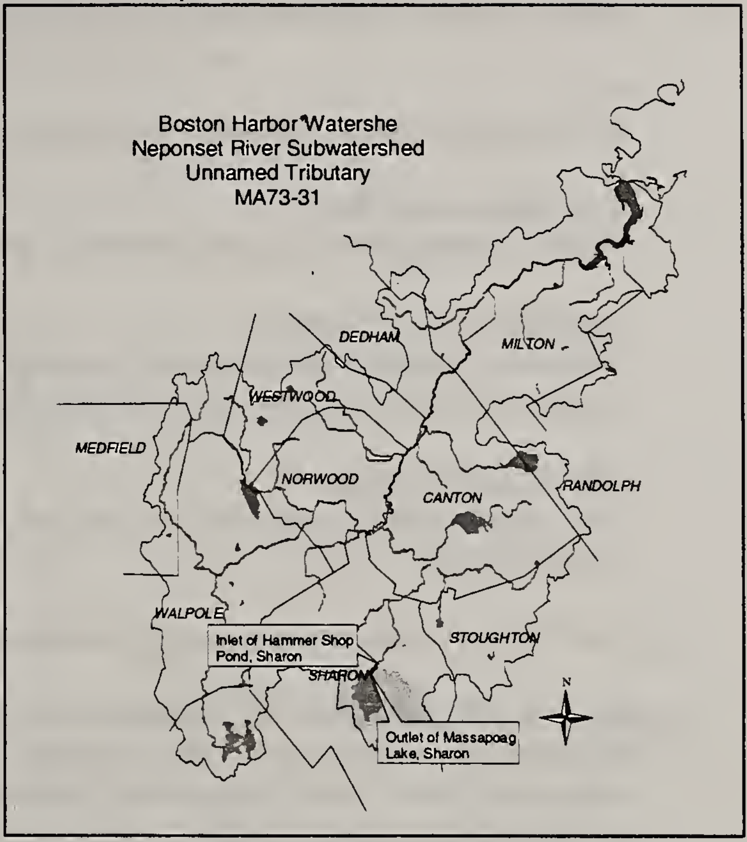
RECOMMENDATIONS BEAVER BROOK (MA73-19)

- Investigate possible sources of reduced baseflow in Beaver Meadow Brook including the impacts of water supplies, private water use, and sewer infiltration and inflow.

- Conduct a fish population survey to investigate the possible reasons for the low densities of fish in this brook.

UNNAMED TRIBUTARY (SEGMENT MA73-31)

Location: Outlet of Massapoag Lake, Sharon to inlet of Hammer Shop Pond, Sharon.
Segment Area: 0.2 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	43%
Residential	33%
Open Land	6%

The use assessment for Lake Massapoag is provided in the Lakes section of this assessment report (Table 11). A lake management strategy, recommended by the Lake Management Committee and adopted by the Sharon Selectmen, is to control the lake's surface water temperature. This thermally stratified lake typically has summer surface temperatures at or below 83°F. The Town determined that blue green algae responsible for swimmers' ear infections begin to thrive at 85°F. Discharge from the lake is regulated in the summer months to reduce surface temperatures for human health concerns. The Town is required to release 1.7 cfs from the lake for protection of downstream wetlands (ACOE 1998).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Sharon Water Department	4266000	9P41926601	41926603	01G 02G 03G	0.42 permitted 0.55 registered	Not available

SURFACE NPDES DISCHARGE SUMMARY:

There are no wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Habitat/Flow

The Town of Sharon has municipal groundwater wells abutting Lake Massapoag. These wells have historically resulted in reduced outflow from the lake which subsequently reduced flows downstream (NepRWA 2001b).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in this unnamed tributary at one station (the outlet of Lake Massapoag, MPB009) from 1999 to 2001 (NepRWA 2001a and b). Water quality samples were analyzed for pH, temperature total suspended solids, ammonia, and total phosphorus. Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature
All temperature measurements (n=6) were below the SWQS for a Class B waterbody.

pH
pH ranged between 6.6 and 7.6 SU (n=6).

Total Suspended Solids
TSS concentrations ranged between 1 and 10.5 mg/L (n=11).

Ammonia-Nitrogen (as N)
Ammonia concentrations ranged from BDL to 0.03 mg/L (n=11). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)
Total phosphorus concentrations ranged from 0.01 to 0.118 mg/L (n=11) with two samples greater than 0.05 mg/L.

Too little instream data were available to assess the *Aquatic Life Use*; therefore, it is not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling between 1999 and 2001 in conjunction with water quality monitoring (NepRWA 1999 and 2001a and b). Fecal coliform bacteria counts (n=11) ranged between 3 and 490 cfu/100mL with only one count greater than 400 cfu/100mL (collected during wet weather conditions). Samples were collected during both wet and dry weather conditions. During the primary contact season fecal coliform bacteria counts ranged between 10 and 490 cfu/100mL (n=6). It should be noted that the Town of Sharon is served mainly (approximately 97%) by on-site septic systems.

Based on the low fecal coliform bacteria counts during wet and dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity and high aesthetic value (NepRWA 1999 and 2001a and b).

Based on the high aesthetic quality of this brook the *Aesthetics Use* is assessed as support.

Unnamed Tributary (MA73-31) Use Summary Table

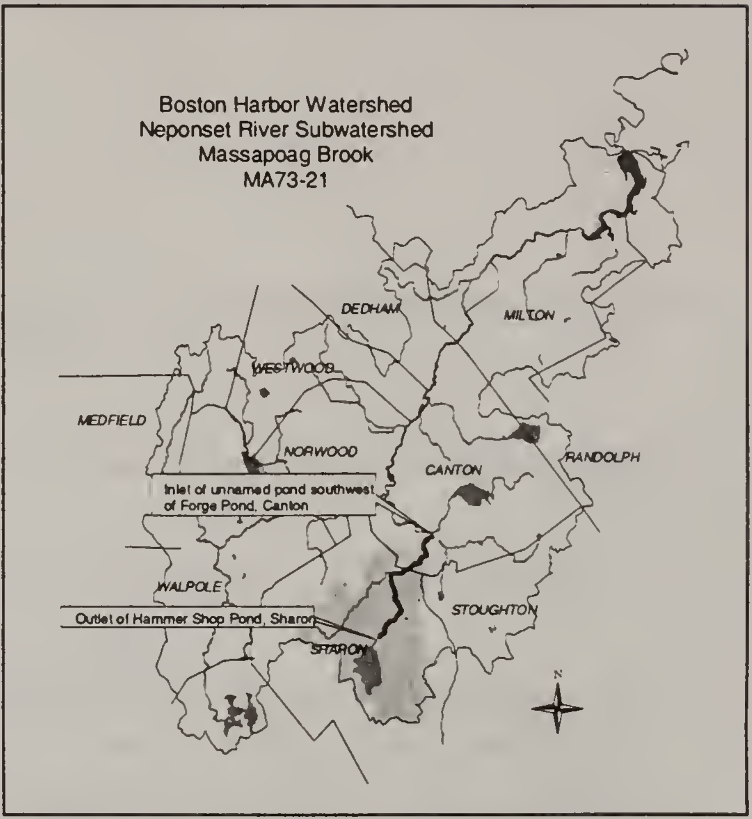
Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

RECOMMENDATIONS UNNAMED TRIBUTARY (MA73-31)

- Investigate possible causes of reduced baseflow in the Massapoag subwatershed including the impacts of water withdrawal and sewer infiltration and inflow.

MASSAPOAG BROOK (SEGMENT MA73-21)

Location: Outlet Hammer Shop Pond, Sharon, through Manns Pond, Trowel Shop Pond, and Shepard Pond to the inlet of unnamed pond southwest of Forge Pond, Canton.
Segment Area: 4.0 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	44%
Residential	37%
Open Land	7%

This segment is on the 1998 303(d) list of impaired waters for unknown causes (MA DEP 1999a). In 2001, DFWELE stocked trout in Massapoag Brook for the purpose of recreational fishing (DFWELE 15 March 2001). Hammershop Pond Dam, Knifeshop Pond Dam, Manns Pond Dam, Trowel Shop Pond Dam, and Shepard Pond Dam are located along this segment. Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm. The use assessments for Hammer Shop, Manns, and Billings Street/East ponds are provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Sharon Water Department	4266000	9P41926601	41926603	01G 02G 03G	0.42 permitted 0.55 registered	Not available

The Town of Sharon has municipal groundwater wells abutting Lake Massapoag. These wells have historically resulted in reduced outflow from the lake subsequently reducing flows downstream (NepRWA 1998).

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted benthic macroinvertebrate and fish population sampling at station 9BOB, downstream from Manns Pond, Sharon (Appendix C). Despite the excellent habitat the benthic community was only 59% comparable to the warm-water reference station (i.e., "slightly impacted"). The community was dominated by relatively few taxa—most notably, the net-spinning caddisflies Hydropsychidae and Philopotamidae--indicating an unbalanced community responding to an overabundance of fine particulate organic matter (FPOM) in the water column.

The 1999 fish population at 9BOB was dominated (80%) by "pond" species including: brown bullhead (*Ameiurus nebulosus*), bluegill (*L. macrochirus*), and pumpkinseed (*L. gibbosus*). Additionally, largemouth bass (*M. salmoides*), golden shiner (*Notemigonus crysoleucas*), white sucker (*C. commersoni*) and American eel (*A. rostrata*) were also collected. The fish community at 9BOB was clearly influenced by upstream impoundments.

NepRWA conducted benthic macroinvertebrate sampling twice (October and November) during their 1999 monitoring efforts in Massapoag Brook (Berasi and Harrahy 2001). The biomonitoring station (MAB5-C) was located downstream from Quincy Street in Sharon—approximately 1.75 km upstream from DWM's 9BOB station. As with the 9BOB station, filter-feeding caddisflies dominated the benthic assemblage on both dates here--hydropsychids being particularly hyperdominant, with mean percent compositions of 94% and 82% respectively. Thus, the same impoundment effects thought to shape benthic community structure at 9BOB occur at MAB5-C as well. Massapoag Lake, located immediately upstream from MAB5-C, clearly provides a major source of FPOM for filter-feeding dominated communities such as MAB5-C and elsewhere in this portion of Massapoag Brook.

Habitat/Flow

Significant deposits of FPOM were observed on much of the instream substrates; however, this benthic sampling site received the highest habitat score of any site in the Boston Harbor Watershed (Appendix C). Immediately upstream of this station is Manns Pond, a eutrophic pond containing dense non-native macrophytes.

ACOE states that during low flow conditions, flows in Massapoag Brook are diverted above Third Pond via a watershed saddle channel to Clay Meadow Brook, which drains to Steep Hill Brook and then into Bolivar Pond (ACOE 1998).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Massapoag Brook at Walnut Street (MPB088) from 1999 to 2001. Water quality samples were analyzed for DO, pH, temperature total suspended solids, ammonia, and total phosphorus (NepRWA 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=7).

pH

pH ranged between 6.5 and 7.3 SU (n=6).

Total Suspended Solids

TSS concentrations ranged between BDL and 19 mg/L (n=8).

Ammonia-nitrogen (as N)

Ammonia concentrations ranged between 0.005 and 0.052 mg/L (n=8). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.026 and 0.140mg/L (n=9) with four measurements greater than 0.05 mg/L.

The *Aquatic Life Use* for Massapoag Brook is assessed as partial support based on slightly impacted biological communities (benthic macroinvertebrates dominated by filter-feeders at 9BOB and MAB5-C, and fish assemblage dominated by pond species at 9BOB) and slightly elevated nutrients.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in Massapoag Brook was conducted by NepRWA in conjunction with water quality monitoring at one site (at Walnut Street) (NepRWA 2001a and b). Fecal coliform bacteria counts ranged between 22 and 480 cfu/100mL (n=9). One out of the nine samples had a concentration above 400 cfu/100mL. This sample was collected during wet weather conditions. During the primary contact recreation season five samples were collected (40 to 181 cfu/100mL). It should be noted that the Town of Sharon is served mainly (approximately 97%) by on-site septic systems.

The *Primary* and *Secondary Contact Recreational* uses are assessed as support for Massapoag Brook based on the low levels of fecal coliform bacteria during both wet and dry weather conditions.

AESTHETICS

There was no evidence of objectionable conditions noted during the 1999 DWM biomonitoring survey (i.e., odors, trash and debris, oils) (Appendix C). NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity (NepRWA 2001a and b).

Based on the high aesthetic quality of Massapoag Brook the *Aesthetics Use* is assessed as support.

Massapoag Brook (MA73-21) Use Summary Table

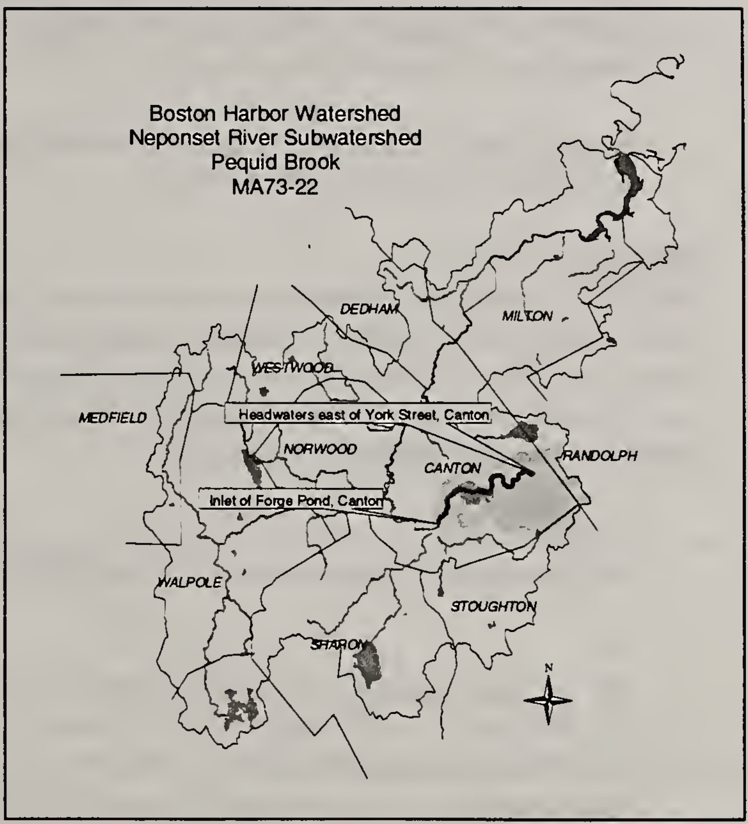
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Unknown, nutrients	Low flows	Unknown	
Fish Consumption		NOT ASSESSED				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

RECOMMENDATIONS MASSAPOAG BROOK (MA73-21)

- Investigate possible sources of reduced baseflow in the Massapoag subwatershed including the impacts of reservoir management practices and sewer infiltration and inflow.
- Work with ACOE, DFWELE, and NepRWA to determine the feasibility of dam removal on man-made impoundments on Massapoag Brook.

PEQUID BROOK (SEGMENT MA73-22)

Location: Headwaters east of York Street, Canton, through Reservoir Pond, to the inlet of Forge Pond, Canton. (Locally known as Pequit Brook)
Segment Area: 3.8 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	42%
Residential	28%
Open Land	9%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO, and pathogens (MA DEP 1999a). The Reservoir Pond Dam is located within this segment. It is maintained by the Plymouth Rubber Company (ACOE 1998).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted benthic macroinvertebrate and fish population studies at station PB01, approximately 0.50 miles upstream from Sherman Street, Canton. This station was 88% comparable (i.e., "non-impacted") to the warm-water reference station at Hawes Brook (Appendix C). Station PB01 displayed optimum benthic community structure and well-balanced trophic structure with some of the highest diversity in the Neponset River subwatershed. However, species (P*arametriocnemus sp.)* often associated with low flows were present in the benthic community. Fish species present in order of abundance included: largemouth bass (*M. salmoides*), black crappie (*Pomoxis nigromaculatus*), brown bullhead (*A. nebulosus*), bluegill (*L. macrochirus*), redfin pickerel (*E. americanus*), white sucker (*C. commersoni*), and American eel (*A. rostrata*). The fish assemblage was influenced by upstream and downstream impoundments and possible periodic low flow events.

As part of the benthic macroinvertebrate sampling phase of BUDGETS, NepRWA conducted biomonitoring at two stations on Pequid Brook in 1999 (PEB5-A and PEB5-B). PEB5-A was located downstream of York Street in Canton—the upper extent of this segment. Overall macroinvertebrate densities were low here. Isopods--generally considered tolerant of organic pollution and low dissolved oxygen levels--dominated the benthos during three rounds of sampling between August 1999 and August 2000. As a result, the PEB5-A macroinvertebrate community was characterized by low overall richness, a high biotic index, and reduced trophic structure. Instream habitat constraints and dissolved oxygen deficiencies associated with the wetland-oriented nature of this low-gradient portion of Pequid Brook, as well as naturally unproductive headwater conditions may account for the low macroinvertebrate density and richness (Berasi and Harrahy 2001).

Habitat/Flow

As part of DEP DWM's 1999 benthic macroinvertebrate and fish population studies at station PB01 a habitat survey was conducted (Appendix C). Optimal benthic macroinvertebrate and fish habitat was identified in the sampling reach.

Pequid Brook discharges to the northern lobe of Lower Forge Pond via a conduit through a commuter rail embankment (ACOE 1998).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Pequid Brook at Sherman Street (PQB040) from 1999 to 2001. Water quality samples were analyzed for DO, pH, temperature total suspended solids, ammonia, and total phosphorus (NepRWA 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=6).

pH

pH ranged between 6.6 and 7.0 SU (n=7)

Total Suspended Solids

TSS concentrations ranged between BDL and 7 mg/L (n=10)

Ammonia-nitrogen (as N)

Ammonia concentrations ranged between 0.004 and 0.074 mg/L (n=11). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.028 and 0.07 mg/L (n=11) with only two samples greater than 0.05 mg/L.

Based on healthy benthic and fish communities at PB01, high habitat quality, landuse information and good overall water chemistry the *Aquatic Life Use* for Pequid Brook is assessed as support. Pequid Brook is, however, on “Alert Status” due to periodic low base flow, possibly the result of flow regulation at the various impoundments, and a potentially impaired benthic community at PEB5-A.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Fecal coliform bacteria sampling in Pequid Brook was conducted by NepRWA in conjunction with water quality monitoring (NepRWA 2001a and b). Fecal coliform levels ranged between 11 and 440 cfu/100mL (n=11) with six samples collected during the primary contact recreation season (range 160 to 440 cfu/100mL). The one count greater than 400 cfu/100mL was collected during mixed/wet weather conditions.

The *Primary* and *Secondary Contact Recreational* uses are assessed as support for Pequid Brook based on the low levels of fecal coliform bacteria during both wet and dry weather conditions.

AESTHETICS

This stream was noted to have high aesthetic quality with no evidence of non-point source pollution and no objectionable conditions (i.e., odors, trash and debris, oils) during the 1999 DWM biology survey (Appendix C). NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity (NepRWA 2001a and b).

Based on the high aesthetic quality of Pequid Brook the *Aesthetics Use* is assessed as support.

Pequid Brook (MA73-22) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	SUPPORT*				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

* “Alert Status” issues identified – See *Aquatic Life Use* Assessment

RECOMMENDATIONS PEQUID BROOK (MA73-22)

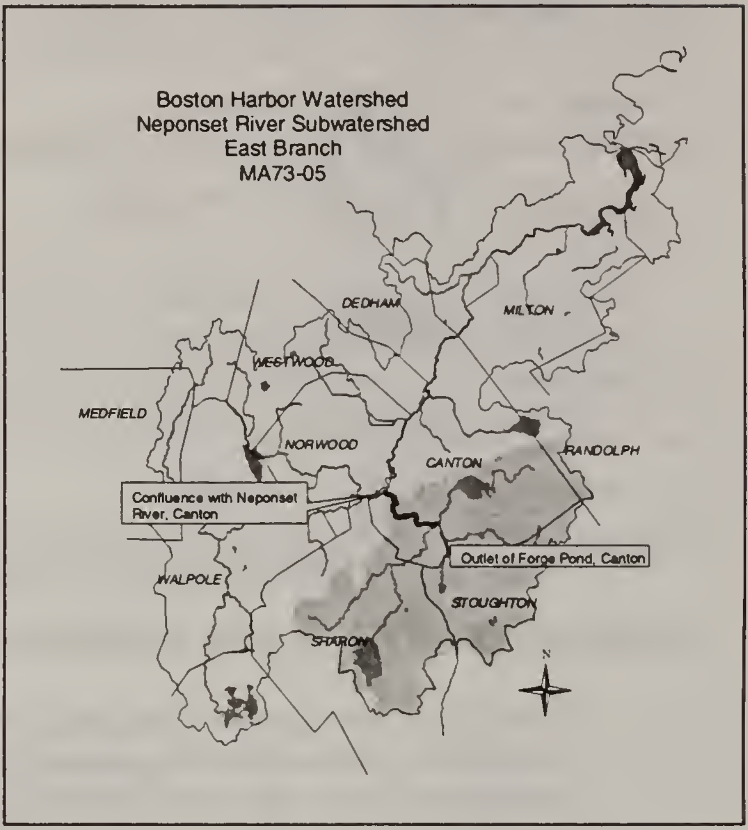
- Continue to monitor and evaluate summer instream water temperatures from Pequid Brook to determine if high water temperatures documented by ACOE in the 1998 Use Attainability Study at the outlet of Reservoir Pond and throughout the East Branch Neponset River subwatershed persist.

- Investigate water release practices in this subwatershed and establish if they may be affecting summer seasonal low flows.

- Water quality (DO, pH, temperature, total suspended solids, ammonia, and total phosphorus) monitoring is recommended upstream from Reservoir Pond to better assess potential impacts to the benthic macroinvertebrate community in this portion of Pequid Brook.

EAST BRANCH NEPONSET RIVER (SEGMENT MA73-05)

Location: Outlet of Forge Pond, Canton, through unnamed pond southwest of Forge Pond and East Branch Pond, to confluence with Neponset River, Canton (locally known as Canton River)
Segment Area: 3.2 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	40%
Forest	37%
Open Land	7%

This segment is on the 1998 303(d) list of impaired waters for cause unknown, metals, thermal modifications, flow alterations, and pathogens (MA DEP 1999a). Forge Pond Dam is located along the East Branch Neponset River (ACOE 1998).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)*	1999 Average Withdrawal (MGD)
Canton Water Department	3050000	9P31905001		10G 05G 04G	1.26	0.62
Canton Water Department	3050000	9P31905001		09G	See NOTE below	
Plymouth Rubber Co., Inc.			31905003	River	2.39	0.37
Stoughton DPW-Water Division	4285003			01G 02G 03G	Not available	Not available

NOTE: The Town of Canton WMA permit, newly issued November 2000, includes conditions from the District's Interbasin Transfer Approval to maintain instream flow and provide protection for the aquatic life in the Neponset River. The limits include (LeVangie 2001):

1) withdrawal from Well #9 is limited to the periods and streamflow thresholds as follows: (Nov. 16- March 14) 0.28 cubic feet per second per square mile (cfsm), (March 15- June 15) 0.81 cfsm, (June 16 – Sept. 14) 0.28 cfsm, (Sept. 15 – Nov. 15) 0.45 cfsm;
2) no withdrawals from the Well # 9 between March 15 and June 15 when the flow in the Neponset River is less than one foot in depth or 100 cfs below the Milton Lower Falls Dam;
3) Canton shall install a staff gage near the Dedham-Westwood Fowl Meadow Well to provide information on water depth; and
4) the Water District will submit annual reports detailing gage readings and volumes pumped from the Fowl Meadow Well.

NPDES DISCHARGE SUMMARY:

Plymouth Rubber (MA0000884) is permitted to discharge 2.6 MGD of NCCW via outfalls 002-007 and storm water via outfall 001 to the East Branch Neponset River. The facility's permit includes a TSS limit of 50 mg/L and requires a SWPPP. The permit expired October 2001. The facility has installed cooling towers and no longer discharges NCCW. EPA is currently evaluating the need for a NPDES permit and may instead require the facility to obtain a general storm water permit (Hogan 2001).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999 DEP DWM conducted benthic macroinvertebrate and fish population studies at station: NE12, downstream from Neponset Street, Canton (Appendix C). The benthos assemblage at this station was only 53% comparable to the warm-water reference station. The “slightly/moderately impacted” status was the poorest received by a Neponset River subwatershed biomonitoring station during the 1999 survey (Appendix C). The unbalanced assemblage was dominated by pollution tolerant filter-feeding taxa and indicated high levels of FPOM in the sampling reach.

Fish sampling efficiency at this station was rated poor due to fast, deep, and turbid water (Appendix C). Fish species present in order of abundance included fallfish (*Semotilus corporalis*), redbreasted sunfish (*L. auritus*), American eel (*A. rostrata*), bluegill (*L. macrochirus*), black crappie (*P. nigromaculatus*), yellow bullhead (*Ameiurus natalis*), largemouth bass (*M. salmoides*), and spottail shiner (*Notropis hudsonius*). Overall numbers of fish were very low (n=36) and were consistent with the 1994 DEP fish survey conducted under similar conditions at this station.

Habitat/Flow

As part of DEP DWM’s 1999 benthic macroinvertebrate and fish population studies at station PB01 a habitat survey was conducted (Appendix C). Good instream benthic macroinvertebrate and fish habitat was identified in the sampling reach, however much of the sampling reach is channelized and a portion of the “rip-rapped” section was deteriorating, resulting in erosion and bank instability. Additionally, significant deposits of FPOM were observed on much of the instream substrates.

As part of the *Use Attainability Study of the East Branch Neponset River Canton, Stoughton, and Sharon Massachusetts*, ACOE determined that low flows (<10 cfs) during the summer months are common. ACOE notes that about 3% of the homes in Sharon and 70% of the houses in Canton are sewered. The wastewater is processed by the MWRA Deer Island WWTP and is transferred out of the subbasin (ACOE 1998). Additionally, flow in the East Branch Neponset River is regulated by upstream impoundments and may be diverted for the municipal supply of Canton and Stoughton.

The Plymouth Rubber Company operates one dam in the Revere Court impoundment section of the East Branch Neponset River and diverts flow for use as non-contact cooling water. The Corps built a second dam, adjacent to the Plymouth Rubber Company dam, in the early 1960’s as part of the Neponset River Basin Flood Control Project. The East Branch Neponset River flows under Plymouth Rubber Company and out the downstream end through three culverts to Factory Pond impoundment. The Canton Local Protection Project can also divert up to 2,100 cfs of water during flood conditions to a 1,600-foot channel that empties to Factory Pond, while leaving 900 cfs in the stream channel.

The average monthly flows measured at USGS gage 0110550 near the Washington Street Bridge during the summer months are presented in Table 7 below (Socolow *et al.* 1998, 1999, 2000, and 2001). From 1997 through 2000, flows in the East Branch Neponset were consistently lowest in July. The seven-day, ten-year low flow for the East Branch Neponset River at USGS gage 0110550 is 3.4 cfs (ACOE 1998).

Table 7. Average Monthly Flows (cfs) on the East Branch Neponset River as Measured at the USGS Gage 0110550 (Socolow *et al*.1998, 1999, 2000, and 2001).

Water Year	June	July	August	September	Summer Average
1997	33.7	17.6	21.8	20.9	23.5
1998	37.0	18.8	22.0	20.9	24.7
1999	36.4	18.8	21.6	22.0	24.7
2000	37.0	18.9	21.5	21.9	24.8
Average per month	36.0	18.5	21.7	21.4	24.4

Chemistry - water

NepRWA conducted bimonthly water quality monitoring on the East Branch Neponset River at Neponset Street (station EAB010) from 1998 to 2001. Water quality samples were analyzed for DO, pH, temperature, total suspended solids, ammonia, and total phosphorus (as P) (NepRWA 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=14). It should be noted that only four of the measurements were collected during the summer months of June, July, August, and September.

The ACOE *Use Attainability Study of the East Branch Neponset River Canton, Stoughton, and Sharon Massachusetts* determined that the East Branch Neponset River subwatershed has many characteristics that would cause excessively warm water temperatures to occur during summer. These include: numerous impoundments, wetlands, and open-canopy, slow moving stream reaches. As part of the study, ACOE collected hourly water temperatures at the outlet of Lake Massapoag, at the outlet of Reservoir Pond, at Upper Factory Pond at Revere Court, and at Lower Factory Pond above the Neponset Street dam. These data showed important information on the thermal behavior of the watershed; the smaller impoundment temperatures were dependent on water temperatures in Massapoag Lake and Reservoir Pond and also on air temperatures. The ACOE identified the basic problem causing high water temperatures in this subwatershed as low flow through large, open areas during warm weather. Although the ACOE presented multiple solutions, only the removal of unused dams was deemed possible for further consideration. Dams that could be considered for removal include Hammer Shop, Manns, and Trowel Shop dams, thereby reducing the subsequent impoundments (ACOE 1998).

pH

pH ranged from 7.5 to 10.4 SU (n=13) with only one measurement above 8.5 SU.

Total Suspended Solids

TSS concentrations ranged between 1 and 34 mg/L (n=17) with only one greater than 25 mg/L.

Ammonia-nitrogen (as N)

Ammonia concentrations ranged between 0.015 and 0.112 mg/L (n=18). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus (as P) concentrations ranged between 0.03 and 0.124 mg/L (n=17) with two measurements greater than 0.1 mg/L.

Chemistry- sediment

As part of the DEP 1994 survey, sediment chemical analyses were conducted on the East Branch Neponset River. Several analytes (TKN, Cd, Cr, Cu, and Pb) exceeded the S-EL threshold, while the remainder fell into the intermediate category (Kennedy et al. 1995).

The *Aquatic Life Use* for the East Branch Neponset River is assessed as non-support due to an impaired benthic community (unbalanced assemblage dominated by pollution tolerant filter-feeding taxa), increased levels of both suspended and deposited FPOM, flow alteration, and contaminated sediments.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling in the East Branch Neponset River in conjunction with their water quality monitoring (NepRWA 1999, 2000, and 2001a and b). Samples were collected during wet and dry weather conditions. Fecal coliform bacteria counts (n=18) ranged between 8 and 17,000 cfu/100mL with six samples greater than 400 cfu/100mL and three samples greater than 2,000 cfu/100mL. Eight samples were collected during the primary contact recreation season (range 30 to 17,000 cfu/100mL) with four counts greater than 400 cfu/100mL (50%) and two counts greater than 2,000 cfu/100mL. The highest count was collected during dry weather conditions.

Based on elevated fecal coliform bacteria counts during dry weather conditions, the *Primary Contact Recreation Use* is assessed as non-support. The *Secondary Contact Recreation Use* is assessed as partial support based on the low frequency of elevated bacteria counts.

AESTHETICS

There were visual observations of instream turbidity with no evidence of trash and debris noted during the 1999 DWM biomonitoring survey. Potential non-point source pollution may originate from road runoff, lawns, and parking lots (Appendix C). However, NepRWA's water quality sampling (TSS data) indicated relatively low instream turbidity with good water clarity (NepRWA 1999, 2001a and b).

Based on overall good aesthetic quality (i.e., no evidence of trash and debris, odors), in the East Branch Neponset River, the *Aesthetics Use* is assessed as support. The East Branch Neponset River is, however, on "Alert Status" due to visual observations of high instream turbidity.

East Branch Neponset River (MA73-05) Use Summary Table

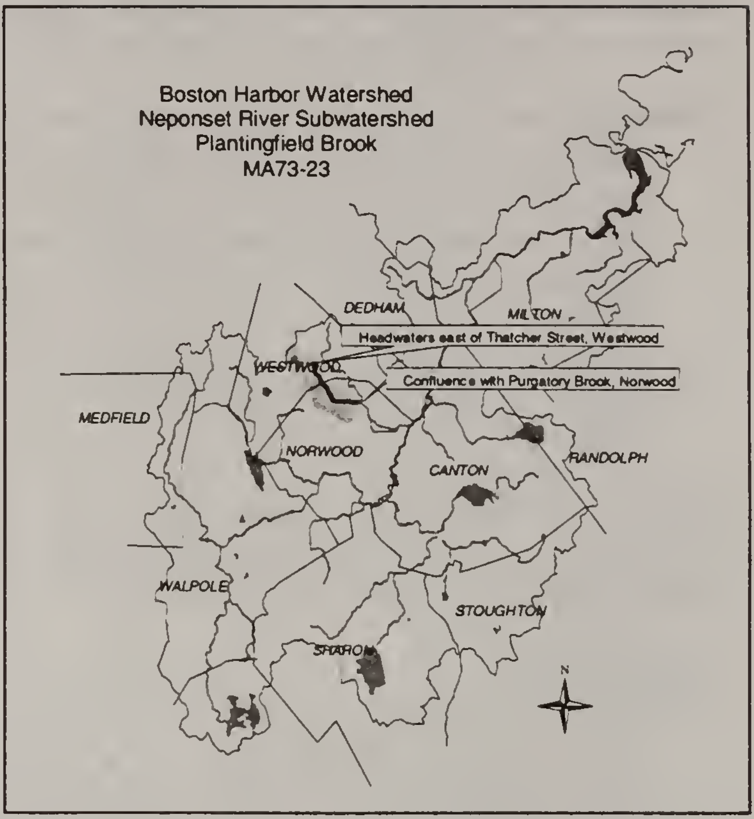
Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NON-SUPPORT	Flow alteration, Unknown, metals, organic enrichment		Hydromodification (upstream impoundments), unknown, industrial point source, contaminated sediments	
Fish Consumption	NOT ASSESSED				
Primary Contact	NON-SUPPORT	Pathogens		Urban runoff/ storm sewers	
Secondary Contact	PARTIAL SUPPORT	Pathogens		Urban runoff/ storm sewers	
Aesthetics*	SUPPORT*				

* "Alert Status" issues identified – See *Aesthetics Use* Assessment

RECOMMENDATIONS EAST BRANCH NEPONSET RIVER (MA73-05)

- Work with ACOE, DFWELE, and NepRWA to determine the feasibility of dam removal on man-made impoundments on the East Branch Neponset River.
- Work with NepRWA to determine the dry weather sources of fecal coliform bacteria contamination in the East Branch Neponset River.
- Conduct additional sediment analyses to determine if contamination is localized.

PLANTINGFIELD BROOK (SEGMENT MA73-23)



Location: Headwaters east of Thatcher Street, Westwood, to the confluence with Purgatory Brook, Norwood.
Segment Area: 2.0 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	42%
Forest	31%
Open Land	10%

This segment is on the 1998 303(d) list of impaired waters for flow alteration (MA DEP 1999a).

This segment is located within the Fowl Meadow/Ponkapoag Bog ACEC (MA DEM August 2000). The use assessment for Lymans Pond is presented in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY AND NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

During extreme rainfall events the Town of Norwood sewer system overflows raw sewage through a known SSO location along this segment of Plantingfield Brook (NepRWA 2002).

USE ASSESSMENT

Plantingfield Brook (MA73-23) Use Summary Table

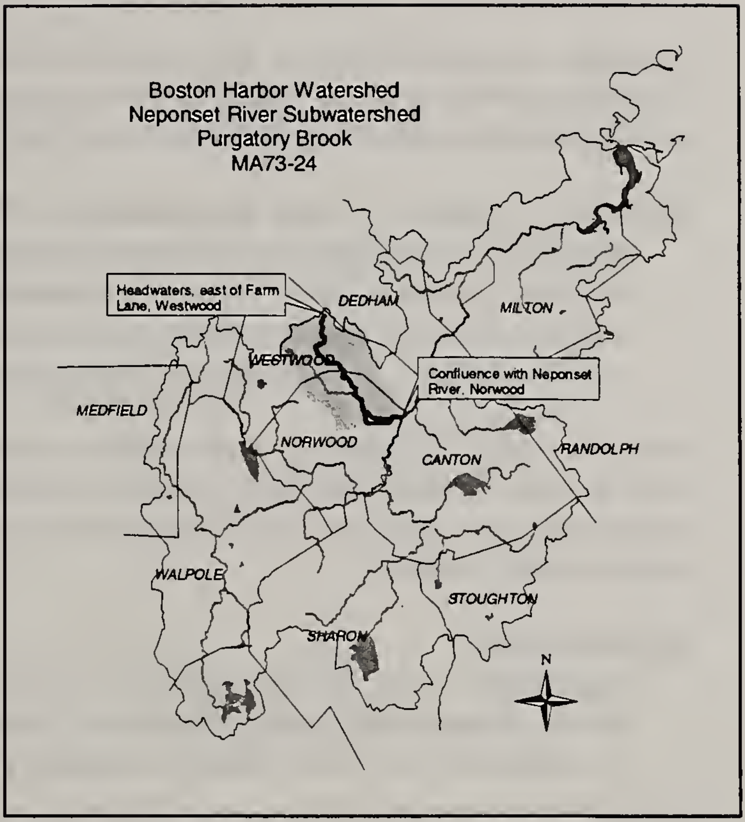
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS PLANTINGFIELD BROOK (MA73-23)

- Work with the Town of Norwood to eliminate the discharge of raw sewage through sanitary sewer overflow (SSO) locations and to minimize the immediate impacts of these current overflows.

PURGATORY BROOK (SEGMENT MA73-24)

Location: Headwaters, east of Farm Lane, Westwood, to confluence with Neponset River, Norwood
Segment Area: 4.9 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	35%
Residential	33%
Industrial	11%

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

This segment is located within the Fowl Meadow/Ponkapoag Bog ACEC (MA DEM August 2000).

WMA WATER WITHDRAWAL SUMMARY AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Purgatory Brook at Route 1A, near Everett Street (PUB022) from 1999 to 2001. Water quality samples were analyzed for DO, pH, temperature, total suspended solids, ammonia, and total phosphorus (NepRWA 1999 and 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=7).

pH

pH ranged between 6.9 and 7.7 SU (n=6).

Total Suspended Solids

TSS concentrations (n=11) ranged between BDL and 120 mg/L with only one measurement greater than 25 mg/L (wet weather).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between BDL and 0.048 mg/L (n=11). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.034 and 0.260 mg/L with three measurements greater than 0.05 mg/L and one measurement greater than 0.1 mg/L (n=10).

Too little instream biological and chemical data (spatial and temporal coverage) were available; therefore Purgatory Brook is not assessed for the *Aquatic Life Use*. Prugatory Brook is, however, on "Alert Status" due to elevated total phosphorus concentrations.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling in Purgatory Brook (PUB022) in conjunction with their water quality monitoring between 1999 and 2001(NepRWA 1999 and 2001a and b). Fecal coliform bacteria counts ranged between 17 and 450 cfu/100mL (n=11) with only one sample above 400 cfu/100mL. Sampling was conducted during both wet and dry weather conditions.

While one bacteria count was elevated above the *Primary Contact Recreational Use* guidance, too little data were available to assess this use; it is not assessed. However, since no bacteria counts during wet or dry weather conditions were elevated above the *Secondary Contact Recreational Use* guidance it is assessed as support.

AESTHETICS

NepRWA's water quality sampling indicated relatively low instream turbidity with good water clarity and high aesthetic quality (NepRWA 1999, 2000, 2001a and b). Just downstream from Route 1A are the remnants of a Brick and Block factory along the stream bank (NepRWA 2002).

Although there was good water clarity, too little current instream data/information were available to assess this use (i.e., not assessed).

Purgatory Brook (MA73-24) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	NOT ASSESSED*				
Fish Consumption	NOT ASSESSED				
Primary Contact	NOT ASSESSED				
Secondary Contact	SUPPORT				
Aesthetics	NOT ASSESSED				

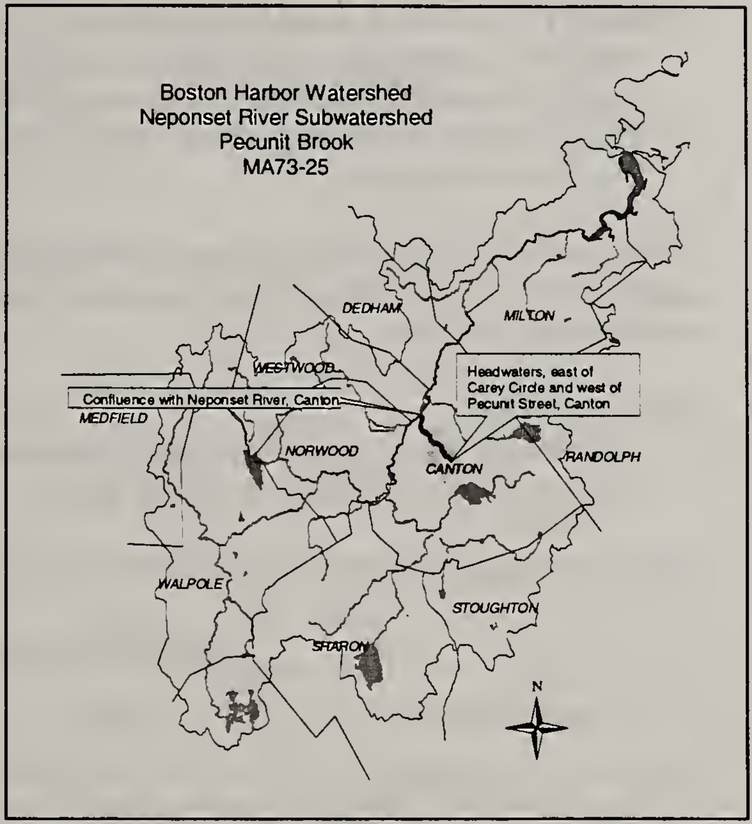
* "Alert Status" issues identified – See *Aquatic Life Use* Assessment

RECOMMENDATIONS PURGATORY BROOK (MA73-24)

- Work with the EOEA Watershed Team and NepRWA to collect additional quality assured data to assess the designated uses of Purgatory Brook.

PECUNIT BROOK (SEGMENT MA73-25)

Location: Headwaters, east of Carey Circle and west of Pecunit Street, Canton to the confluence with Neponset River, Canton.
Segment Area: 1.7 miles.
Classification: Class B.


Boston Harbor Watershed
Neponset River Subwatershed
Pecunit Brook
MA73-25
DEDHAM
MILTON
WESTWOOD
Confluence with Neponset River, Canton
MEDFIELD
Headwaters, east of Carey Circle and west of Pecunit Street, Canton
NORWOOD
CANTON
RANDOLPH
WALPOLE
STOUGHTON
SHARON
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	37%
Residential	23%
Industrial	20%

This segment of Pecunit Brook is within the Fowl Meadow and Ponkapoag Bog ACECs (MA DEM August 2000).

WMA WATER WITHDRAWAL SUMMARY AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Pecunit Brook at Elm Street (PEB008) from 1999 to 2001. Water quality samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (NepRWA 1999, 2000, and 2001). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=5).

pH

pH ranged between 6.9 and 7.4 SU (n=3).

Total Suspended Solids

TSS concentrations ranged between BDL and 11 mg/L (n=10).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.009 and 0.081 mg/L (n=9). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.04 and 0.129 mg/L with two out of the nine measurements greater than 0.1 mg/L.

Too little instream data were available to assess the *Aquatic Life Use* (not assessed). Pecunit Brook is, however, on “Alert Status” due to elevated total phosphorus concentrations.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling in Pecunit Brook in conjunction with their water quality monitoring between 1999 and 2001 (NepRWA 2001 a and b). Fecal coliform bacteria counts ranged between <4 and 320 cfu/100mL (n=9). Sampling was conducted during both wet and dry weather conditions.

Fecal coliform bacteria counts were low both historically and during the 1999 through 2001 wet and dry weather sampling events. Therefore the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

NepRWA’s water quality sampling indicated low instream turbidity with good water clarity and high aesthetic value (NepRWA 2001a and b).

Based on the high aesthetic quality of Pecunit Brook the *Aesthetics Use* is assessed as support.

Pecunit Brook (MA73-25) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		NOT ASSESSED*				
Fish Consumption		NOT ASSESSED				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

* “Alert Status” issues identified—See *Aquatic Life Use* Assessment

RECOMMENDATIONS PECUNIT BROOK (MA73-25)

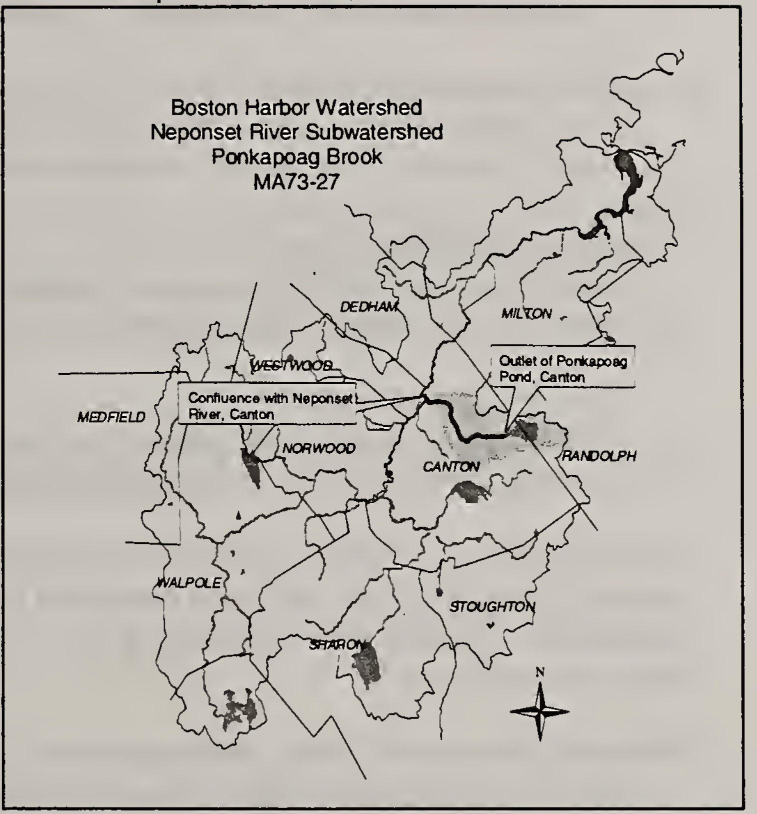
- Work with local area golf courses to reduce water use and nutrient inputs to the Pecunit Brook Subwatershed.

PONKAPOAG BROOK (SEGMENT MA73-27)

Location: Outlet of Ponkapoag Pond, Canton to confluence with Neponset River, Canton
Segment Area: 3.2 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	34%
Residential	25%
Open Land	17%



This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). In 2001, DFWELE stocked trout in Ponkapoag Brook for the purpose of recreational fishing (DFWELE 15 March 2001). This segment is located within the Fowl Meadow/Ponkapoag Bog ACEC (MA DEM August 2000). The central resource features of the Fowl Meadow and Ponkapoag Bog ACEC are the Neponset River and the Ponkapoag Pond and Bog. Ponkapoag Bog and Pond and the natural communities and wildlife habitats form the core resources of the Ponkapoag Bog area. The use assessment for Ponkapoag Pond is provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Blue Hill Country Club			31905001	Irrigation Well	0.37	0.19
Lost Brook Golf Club			31922001	Irrigation Pond	0.22	0.01

SURFACE NPDES DISCHARGE SUMMARY:

There are no wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Ponkapoag Brook at Washington Street (POB024) from 1999 to 2001. Water quality samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (NepRWA 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature readings were below the SWQS for a Class B waterbody (n=5).

pH

pH ranged between 6.2 and 6.7 SU with three samples less than 6.5 SU (n=5).

Total Suspended Solids

TSS concentrations ranged between BDL and 41 mg/L (n=10) with two samples greater than 25 mg/L (collected during wet weather conditions).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged from 0.012 to 0.160 mg/L. All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged from 0.032 to 0.142 mg/L (n=9) with two measurements greater than 0.1 mg/L, both collected during wet weather.

Although pH was slightly low and total phosphorus concentrations were somewhat elevated, too little instream data (i.e., biological and dissolved oxygen) were available to assess the *Aquatic Life Use* (not assessed). The segment, however, is on "Alert Status" due to the possible negative impacts of elevated nutrients and low pH.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling in Ponkapoag Brook in conjunction with their water quality monitoring between 1999 and 2001 (NepRWA 2001a and b). Fecal coliform bacteria counts ranged between 3 and 332 cfu/100mL (n=10). Sampling was conducted during both wet and dry weather conditions.

Fecal coliform bacteria counts were low both historically and during the 1999 through 2001 wet and dry weather sampling events, therefore, the *Primary* and *Secondary Contact Recreational* uses are assessed as support.

AESTHETICS

NepRWA's water quality sampling indicated low instream turbidity with good water clarity and high aesthetic value (NepRWA 2001a and b).

Based on the high aesthetic quality of Ponkapoag Brook the *Aesthetics Use* is assessed as support.

Ponkapoag Brook (MA73-27) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	NOT ASSESSED*				
Fish Consumption	NOT ASSESSED				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

* "Alert Status" issues identified – see *Aquatic Life Use* Assessment

RECOMMENDATIONS PONKAPOAG BROOK (MA73-27)

- Investigate and eliminate possible sources of elevated phosphorus to Ponkapoag Brook.

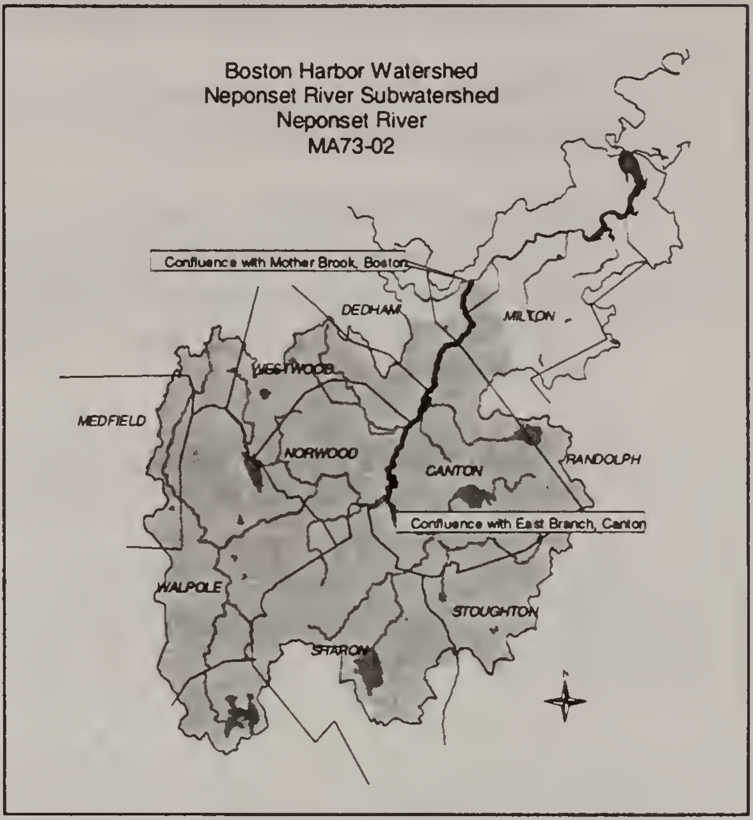
- Collect additional quality assured water quality data to assess the *Aquatic Life Use* and determine if low pH is a problem.

- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e. yard waste disposal practices, reduction of impervious services, and road runoff). Additionally work with local area golf courses to reduce water use and to develop green care practices that will reduce nutrient inputs to the Ponkapoag Brook Subwatershed.

- Total suspended solids concentrations were elevated during wet weather conditions. Investigate sources of solids in the brook including road runoff and erosion.

NEPONSET RIVER (SEGMENT MA73-02)

Location: Confluence with East Branch, Canton to confluence with Mother Brook, Boston
Segment Area: 7.9 miles.
Classification: Class B Warm Water Fishery.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	37%
Residential	35%
Open Land	8%

This segment is on the 1998 303(d) list of impaired waters for priority organics, metals, organic enrichment/ low DO, pathogens, oil and grease, and turbidity (MA DEP 1999a). This segment is located within the Fowl Meadow/Ponkapoag Bog ACEC (MA DEM August 2000). The use assessment for Sprague Pond is provided in the Lakes section of this assessment report (Table 11).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)*	1999 Average Withdrawal (MGD)
Dedham/ Westwood Water Department	3073000	9P31907301	31907301	06G 07G 08G 09G 13G	2.62 registered 0.49 permitted	2.96

* System-wide withdrawal

The Dedham-Westwood Water District WMA permit includes conditions from the Dedham-Westwood Water District's Interbasin Transfer Approval. The limits include:

1) no withdrawal from 13G (Fowl Meadow Well) when streamflow in the Neponset River is less than 0.15 cfsm;
2) no withdrawals from the Fowl Meadow Well during the months of March, April, or May when the flow in the Neponset River is less than one foot in depth or 95 cfs below the Milton Lower Falls Dam;
3) the Water District shall install a staff gage at the Milton Lower Falls Dam to provide information on water depth; and the Water District will submit annual reports detailing gage readings and volumes pumped from the Fowl Meadow Well (LeVangie, 2001).

NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment, however, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry - water

NepRWA collected bimonthly water quality samples from 1997 to 2001 at three stations (upstream to downstream) along this segment of the Neponset River:

NER 125- Neponset River at Dedham Street Bridge, Canton (1999-2001)
NER 130- Neponset River at Green Lodge Street, Canton (1997, 1998)
NER 150- Neponset River at Paul's Bridge, Milton (1997-2001)

Parameters measured included DO, temperature, pH, TSS, ammonia, and total phosphorus (NepRWA 1998, 1999, 2001a and 2001b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperatures were below the SWQS for a Class B waterbody (n=42).

pH

pH ranged from 6.3 to 8.5 SU with only three less than 6.5 SU (n=40).

Total Suspended Solids

TSS concentrations ranged between BDL to 12 mg/L (n=45).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.007 and 0.135 mg/L (n=45). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.036 and 0.100mg/L (n=42) with 27 greater than 0.05mg/L.

Chemistry- sediment

As part of the DEP 1994 survey, sediment chemical analyses were conducted at three stations (Fowl Meadow, Green Lodge St, and downstream Fowl Meadow) on this segment of the Neponset River (Kennedy et al. 1995). Several analytes in the sediments from multiple sampling locations (e.g., TP, TKN, Hg, and Cu) exceeded the S-EL threshold.

Too little current data/information were available to assess the *Aquatic Life Use* (i.e., not assessed) for this segment of the Neponset River. However, this segment of the Neponset River is on "Alert Status" due to the possible negative impacts caused by elevated levels of total phosphorus and the historically high contaminant levels in the sediments.

FISH CONSUMPTION

MDPH issued a fish consumption advisory for the Neponset River from the Hollingsworth and Vose Dam to the Tilestone Dam due to elevated levels of PCBs in fish tissue (MDPH 2001a). The MDPH advisory recommends the following:

1. Children younger than 12-years, pregnant women, and nursing mothers, should not consume any brown bullhead from the Neponset River.
2. The general public should limit consumption of brown bullhead from the Neponset River to two meals per month.

Based on the MDPH site-specific fish consumption advisory, this segment is assessed as non-support for the *Fish Consumption Use*.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA collected fecal coliform bacteria samples on this segment of the Neponset River between 1997-2001 as part of their water quality monitoring program (NepRWA 1998, 1999, 2001a, and 2001b). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged between 8 and 32,000 cfu/100mL (n=48). Fecal coliform bacteria counts collected during the primary contact season ranged between 12 and 32,000 cfu/100mL (n=28) with three dry weather counts above 400 cfu/100mL (11%) and two wet weather counts greater than 2,000 cfu/100mL. There were three counts greater than 4,000 cfu/100mL with only one collected during wet weather conditions.

Due to intermittent elevated levels of pathogens during wet and dry weather conditions the *Primary* and *Secondary Contact Recreational* uses are assessed as partial support.

AESTHETICS

NepRWA's water quality sampling indicated relatively low instream turbidity (NepRWA 1999, 2000, 2001). This segment of the Neponset River is subject to large rafts of storm water debris after rainfall events. Additionally, trash and debris enter the river at the road crossings and from abutting properties.

Due to trash and debris following storm events the *Aesthetics Use* is assessed as partial support.

Neponset River (MA73-02) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	NOT ASSESSED*				
Fish Consumption	NON-SUPPORT	PCBs		Unknown	
Primary Contact	PARTIAL SUPPORT	Pathogens		Urban runoff/ storm sewers	
Secondary Contact	PARTIAL SUPPORT	Pathogens		Urban runoff/ storm sewers	
Aesthetics	PARTIAL SUPPORT	Trash and debris		Urban runoff/ storm sewers	

* "Alert Status" Issues identified – see *Aquatic Life Use* Assessment

RECOMMENDATIONS NEPONSET RIVER (MA73-02)

- Investigate possible sources of total phosphorus to the Neponset River including point and nonpoint sources of pollution.

- The DWM 1994 benthic macroinvertebrate surveys identified a moderately impacted benthic community. Conduct a biological survey on the Neponset River to determine if water quality has improved and the benthic community recovered.

- Conduct additional sediment analyses (metals and toxicity) to determine if the historical contamination is currently impacting water quality and the biota.

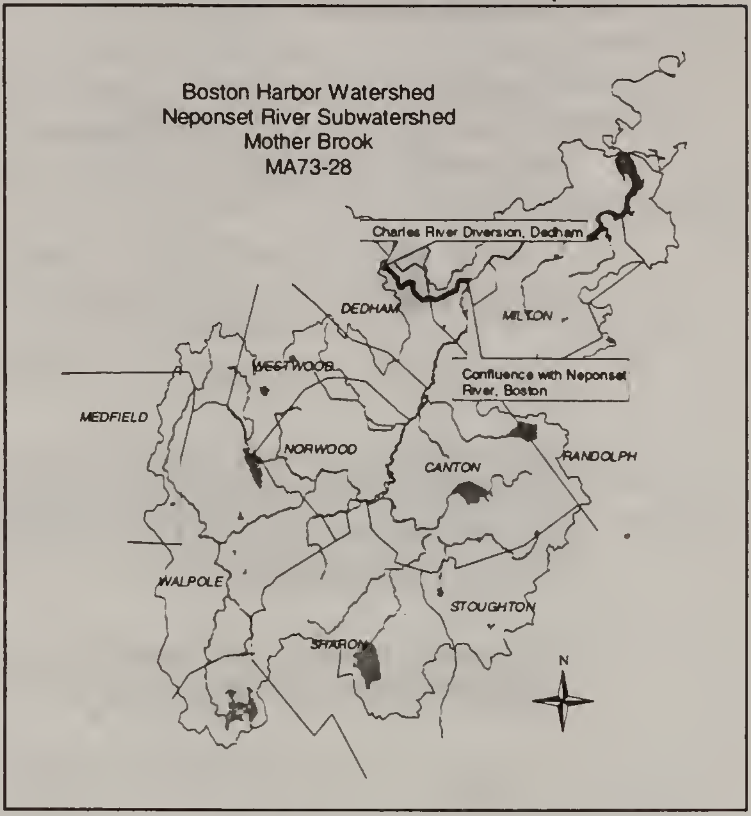
- Continue to monitor pathogen levels in the Neponset River.

- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious services, and road runoff). Additionally, conduct a stream cleanup along this segment of the Neponset River.

- Work with local highway departments to implement BMPs to reduce sediment inputs and trash and debris from road crossings.

MOTHER BROOK (SEGMENT MA73-28)

Location: From its headwaters at the Charles River Diversion, Dedham to confluence with Neponset River, Boston
Segment Area: 3.1 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	59%
Open Land	14%
Commercial	12%

This segment (as MA72-13) is on the 1998 303(d) list of impaired waters for nutrient, organic enrichment/ low DO, and pathogens (MA DEP 1999a). As of May 2000, this segment's WBID has changed to MA73-28 in the Neponset River Subwatershed.

There are three dams within this segment: Mother Brook Dam at Charles River, Mother Brook Dam at Maverick St., and Colburn Street Dam. They are all maintained by the MDC. Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm. The Charles River Diversion is capable of diverting up to one-third of the flow of the Charles River through Mother Brook and into the Neponset River. The MDC regulates the flow twice per year in the spring and fall. The channel of Mother Brook has been altered to contain the large flows associated with this diversion.

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Habitat/Flow

The channel of Mother Brook has been modified to handle the increased flows from the diversion of Charles River water during spring and fall. During dry periods when no water is being diverted the brook flows through a wide flat channel (NepRWA 2002).

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Mother Brook at the Route 1 Dam, Bussey Street, and River Street (MOB001 from 1997 to 2001; MOB010 and MOB020 in 1997). Water quality samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (NepRWA 1999, 2000, and 2001). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

DO

In 1994, DWM surveyed Mother Brook as part of the Neponset River Watershed Project. Dissolved oxygen concentrations (n=8) measured during the survey ranged between 3.8 and 8.5 mg/L with two measurements less than 5.0 mg/L. Additionally, three of the eight percent saturations (range: 41.0-72.9) were less than 60% (Kennedy et al. 1995). Samples were not collected pre-dawn, and therefore, these data do not represent worst-case conditions.

Temperature

All temperature readings were below the SWQS for a Class B waterbody (n=16).

pH

pH ranged between 6.6 and 8.0 SU (n=16).

Total Suspended Solids

TSS concentrations ranged between BDL and 17 mg/L (n=18).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged from 0.013 to 0.253 mg/L (n=11). During 2000 and 2001, ammonia-nitrogen concentrations were slightly elevated, however, temperature and pH data were not available to determine the CCC. Based on the conservative watershed CCC of 0.237 mg/L, two of the eleven measurements exceeded the chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged from 0.055 to 0.157 mg/L (n=10) with three samples greater than 0.1 mg/L.

Based on elevated total phosphorus concentrations, flow alteration, and historically low dissolved oxygen concentrations, the *Aquatic Life Use* for Mother Brook is assessed as partial support.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria sampling in Mother Brook as part of their water quality monitoring between 1997 and 2001 (NepRWA 1998, 1999, 2001a and b). Samples were collected during both wet and dry weather. Fecal coliform bacteria counts ranged between 25 and 2,880 cfu/100mL (n=24) with seven counts greater than 400cfu/100mL and two greater than 2,000cfu/100mL. During the primary contact season, fecal coliform bacteria counts (n=15) ranged between 60 and 2,880 cfu/100mL with six counts greater than 400cfu/100mL (40%).

Based on elevated fecal coliform bacteria counts during dry weather conditions (three in 1997 and one in 2000), the *Primary Contact Recreation Use* is assessed as partial support. The *Secondary Contact Recreation Use* is assessed as support since no counts were elevated above the dry or wet weather guidance.

AESTHETICS

NepRWA's water quality sampling indicated relatively low instream turbidity (NepRWA 1998, 1999, 2001a and b). Objectionable odors and trash and debris have been identified in Mother Brook (NepRWA 2002).

It is best professional judgment that the *Aesthetics Use* for Mother Brook be assessed as support based on water quality data. Mother Brook is, however, on "Alert Status" due to localized areas of trash and debris.

Mother Brook (MA73-28) Use Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Low DO, nutrients, flow alteration		Unknown, hydromodification	Urban runoff/storm sewers
Fish Consumption		NOT ASSESSED				
Primary Contact		PARTIAL SUPPORT	Pathogens		Urban runoff/storm sewers	
Secondary Contact		SUPPORT				
Aesthetics*		SUPPORT*				

* "Alert Status" Issues identified—See *Aesthetics Use* Assessment

RECOMMENDATIONS MOTHER BROOK (MA73-28)

- Identify and reduce possible sources of total phosphorus to Mother Brook including point and nonpoint sources of pollution.

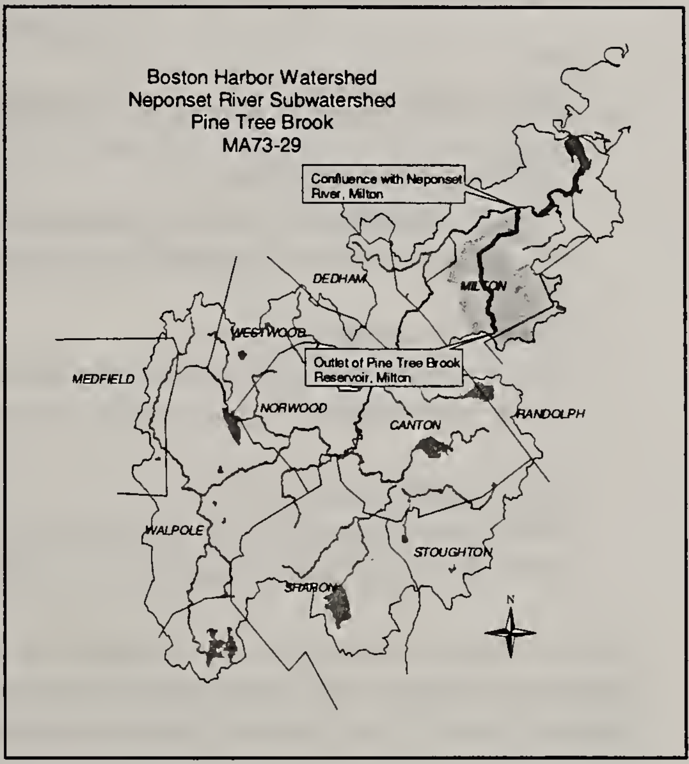
- The MDC regulates the flow to Mother Brook twice per year during spring and fall (Kennedy *et al.* 1995). Work with MDC to manage the release of water during low flows through the Charles River Diversion to increase the habitat quality in Mother Brook.

- Work with the MDC, ACOE, DFWELE, and NepRWA to determine the feasibility of dam removal on man-made impoundments on Mother Brook as a means to increase habitat quality and restore natural stream velocity-depth combinations. If it is determined that removal is unfeasible, consider establishing a plan to address the lack of fish passage at the three dams on this segment.

- In conjunction with the Town of Dedham and the City of Boston, identify and eliminate sources of fecal coliform bacteria contamination to Mother Brook including sewer cross connections.

PINE TREE BROOK (SEGMENT MA73-29)

Location: Outlet of Hillside Pond, Milton through Pope's Pond to confluence Neponset River, Milton.
Segment Area: 4.7 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	47%
Residential	41%
Open Land	8%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO, other habitat alterations, and pathogens (MA DEP 1999a). The use assessment for Popes and Turners ponds are provided in the Lakes section of this assessment report (Table 11). In 2001, DFWELE stocked trout in Pine Tree Brook for the purpose of recreational fishing (DFWELE 15 March 2001). There are three dams located along this segment: Pine Tree Brook Reservoir Dam, Pine Tree Brook Dam, and Harland Street Detention. All three dams are maintained by the Town of Milton (Ryan 2001). Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm.

Since 1997, Central Artery Tunnel project dirt has been trucked to the former West Quincy landfills and the town of Milton's 56-acre landfill. The solid waste is being covered with 20 to 30 feet of historic fill, which is graded, shaped, and then topped with an 18-inch Boston Blue Clay cap (Big Dig 2000).

WMA WATER WITHDRAWAL SUMMARY AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

During extreme rainfall events the Town of Milton sewer system overflows raw sewage through SSO locations along this segment of Pine Tree Brook (NepRWA 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

NepRWA conducted bimonthly water quality monitoring on Pine Tree Brook between 1997 and 2001:

PTB012- Pine Tree Brook at Unquity Road (1997)
PTB022- Pine Tree Brook at Canton Avenue (1997-2001)
PTB028- Pine Tree Brook at Blue Hills Parkway (1998-2001)
PTB035- Pine Tree Brook at Brook Road (1997-2001)
PTB047- Pine Tree Brook at Central Avenue (1997-2001)

Samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (NepRWA 1998, 1999, 2001a, and 2001b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=67).

pH

pH ranged between 6.0 and 8.6 SU (n=59) with four less than 6.5 SU and two greater than 8.5 SU.

Total Suspended Solids

TSS concentrations ranged between BDL and 140 mg/L (n=72) with only four greater than 25 mg/L (three occurred on 22 March 2000 during wet weather conditions).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged from 0.003 to 0.09 mg/L (n=70). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged from 0.004 to 0.274 mg/L (n=67) with 38 greater than 0.05 mg/L and 12 greater than 0.1 mg/L (18%).

Although total phosphorus concentrations were elevated, the data were too limited (i.e., no biological, dissolved oxygen) and therefore the *Aquatic Life Use* for Pine Tree Brook is not assessed. This brook however, is on "Alert Status" due to the possible negative impacts of elevated nutrient concentrations.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA conducted fecal coliform bacteria monitoring of Pine Tree Brook as part of their water quality monitoring program between 1997 and 2001 (NepRWA 1998, 1999, 2001a, and 2001b). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged between <4 and 3,900 cfu/100mL (n=80) with six counts greater than 2000 cfu/100mL (50% during dry weather). During the primary contact season (n=51) 22 counts were greater than 400 cfu/100mL (50% during dry weather).

Based on the elevated pathogen counts collected during dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

Pine Tree Brook (MA73-29) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		NOT ASSESSED*				
Fish Consumption		NOT ASSESSED				
Primary Contact		NON-SUPPORT	Pathogens		Unknown	Illicit sewer connections, municipal point source (SSO)
Secondary Contact		NON-SUPPORT	Pathogens		Unknown	Illicit sewer connections, municipal point source (SSO)
Aesthetics		NOT ASSESSED				

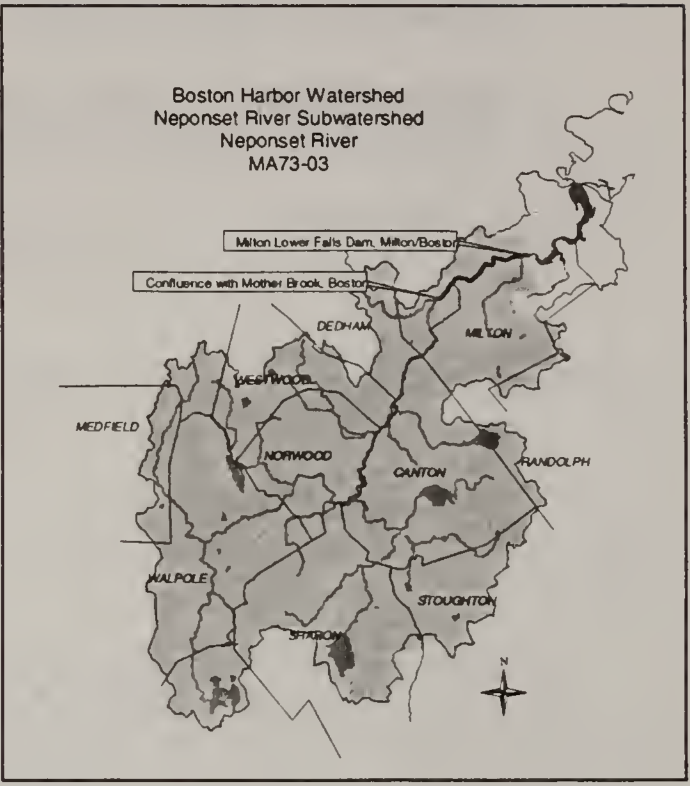
* "Alert Status" issues identified – See *Aquatic Life Use* assessment

RECOMMENDATIONS PINE TREE BROOK (MA73-29)

- In conjunction with ACOE, DFWELE, and NepRWA determine the feasibility/importance of dam removal on man-made impoundments on Pine Tree Brook.
- Work with the Town of Milton to eliminate the discharge of raw sewage through sanitary sewer overflow (SSO) locations and to minimize the immediate impacts of these current overflows.

NEPONSET RIVER (SEGMENT MA73-03)

Location: Confluence with Mother Brook, Boston to Milton Lower Falls Dam, Milton/Boston
Segment Area: 3.7 miles.
Classification: Class B, Warm Water Fishery, CSO*.
(*In the updated 2002 SWQS, the CSO designation will be removed from the Neponset River. See classification section.)



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	37%
Forest	36%
Open Land	9%

This segment is on the 1998 303(d) list of impaired waters for priority organics, metals, organic enrichment/ low DO, pathogens, and oil and grease (MA DEP 1999a). This segment is located within the Neponset River Estuary ACEC (MA DEM August 2000). There are two dams located along this segment of the Neponset River: the Neponset River Dam- Hyde Park and the Lower Mills Dam. A feasibility study for dam removal of the Milton Lower Falls Dam and the second obstruction, Tilestone is underway. In anticipation of improved access to this system DMF has been stocking both American shad and blueback herring into the Neponset system. Since 1996, over 16,000 blueback herring and almost 1000 American shad have been transported from other source systems and released into the upper Neponset River in Canton. The Neponset herring are managed under state regulations (Brady 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Bay State Paper Company			31903501	Neponset River	2.06	0.46

SURFACE NPDES DISCHARGE SUMMARY:

There are no wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry - water

NepRWA collected bimonthly water quality samples at six stations on this segment of the Neponset River between 1997 and 2001:

NER165- Neponset River at Fairmount railroad station (1997-2001)
NER175- Neponset River at Truman parkway (1997)
NER178- Neponset River at Monposet Street (1998)
NER185- Neponset River at Ryan Playground (1997-2001)
NER200- Neponset River at Adams Street Bridge (1997-2001)

NER215- Neponset River at Granite Ave (1998)

Samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (as P) (NepRWA 1998, 1999, 2001a, and 2001b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

MWRA collected water quality samples at one station, 055 (above the dam in Milton at Baker Circle) at the downstream end of this segment of the Neponset River between 1996 and 2000 as part of their ongoing receiving water monitoring program. Parameters measured included DO, percent saturation, temperature, turbidity, and chlorophyll *a* (Coughlin 2002).

DO

MWRA dissolved oxygen concentrations ranged from 2.03 to 17.68 mg/L with only 15 of the 397 samples less than 5.0 mg/L. Percent saturation ranged between 23.8 and 196.4% with 16 less than 60% and three greater than 115% (n=397). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario. It should be noted that the 15 low dissolved oxygen concentrations were recorded during the summer months of June, July and August, in both the surface and bottom waters.

Temperature

All temperature measurements (both NepRWA's and MWRA's) were below the SWQS for a Class B waterbody (n=481).

pH

NepRWA pH measurements ranged from 5.9 to 8.6 SU (n=64) with four less than 6.3 SU and one greater than 8.5 SU.

Turbidity

MWRA turbidity readings ranged between 0 and 37 NTU with an average of 5.81 NTU (n=265).

Total Suspended Solids

NepRWA TSS concentrations ranged between 1 and 64 mg/L (n=91) with five concentrations greater than 25 mg/L (two during dry weather and three, all on the same day, during wet weather).

Ammonia-Nitrogen (as N)

NepRWA ammonia concentrations ranged between 0.011 and 0.333 mg/L (n=84). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.003 and 0.262 mg/L (n=81) with 65 concentrations greater than 0.05 mg/L and 13 greater than 0.1 mg/L (16%).

Chlorophyll a

MWRA chlorophyll *a* concentrations ranged from 0.5 to 312 µg/L (n=178).

Chemistry- sediment

As part of the DEP 1994 survey, sediment chemical analyses were conducted at one station (upstream, Baker Dam) on this segment of the Neponset River (Kennedy *et al.* 1995). Several analytes (e.g., Pb, Hg, and Cu) exceeded the S-EL threshold, while TP, TKN, As, Cd, Cr, Ni and Zn exceeded the L-EL. Oil deposits were also noted during this sediment sampling.

Although total phosphorus concentrations were somewhat elevated and dissolved oxygen concentrations were occasionally low during the summer months, the *Aquatic Life Use* for this segment of the Neponset River is currently not assessed. Historical sediment data indicates that the *Aquatic Life Use* was impaired. Recent sediment data and biological data for this segment are needed to determine if contaminated sediments continue to negatively impact the aquatic life. Due to the probability of negative impacts associated with historically high contaminant levels in sediments and the possible negative impacts caused by elevated levels of total phosphorus and low dissolved oxygen concentrations, this segment of the Neponset River is on “Alert Status”.

FISH CONSUMPTION

MDPH issued a fish consumption advisory for the Neponset River from the Hollingsworth and Vose Dam to the Tilestone Dam due to elevated levels of PCBs in fish tissue (MDPH 2001a). The MDPH advisory recommends the following:

3. Children younger than 12-years, pregnant women, and nursing mothers, should not consume any brown bullhead from the Neponset River.
4. The general public should limit consumption of brown bullhead from the Neponset River to two meals per month.

Based on the MDPH site-specific fish consumption advisory, 0.9 miles of this segment of the Neponset River are assessed as non-support for the *Fish Consumption Use.*

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA also conducted fecal coliform bacteria monitoring on this segment of the Neponset River as part of their water quality monitoring program between 1997 and 2001 (NepRWA 1998, 1999, 2001a, and 2001b). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts (n=91) ranged between 25 and 250,000 cfu/100mL (dry weather). Overall, fecal coliform bacteria counts were greater than 2,000 cfu/100mL on ten occasions (five dry and five wet). During the primary contact season (n=56) 29 counts were greater than 400 cfu/100mL (approximately 50% during dry weather).

MWRA collected fecal coliform bacteria samples as part of their ongoing receiving water monitoring program at one station (055) at the downstream end of this segment of the Neponset River (Coughlin 2002). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged from 70 to 20,800 cfu/100mL (n=251) with 13 counts greater than 4,000 cfu/100mL. The highest count was during dry weather conditions. During the primary contact recreation season, fecal coliform bacteria counts ranged between 120 and 20,800 cfu/100mL with 121 of the 159 samples greater than 400 cfu/100mL (76%).

Based on the elevated pathogen counts collected during dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

AESTHETICS

NepRWA’s water quality sampling indicated relatively low instream turbidity (NepRWA 1998, 1999, 2000, 2001). Large quantities of trash and debris have been identified throughout this segment of the Neponset River (NepRWA 2002). Secchi disk depth readings recorded by MWRA at station 055, at the lower impounded section of this segment, ranged from 6 to 9 m (n=88).

Based on the prevalence of trash and debris, the *Aesthetics Use* for this segment the Neponset River is assessed as non-support.

Neponset River (MA73-03) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	NOT ASSESSED *				
Fish Consumption	NON-SUPPORT 0.9 miles NOT ASSESSED 2.8 miles	PCBs		Unknown	
Primary Contact	NON-SUPPORT	Pathogens		Unknown	Urban Runoff/ storm sewers
Secondary Contact	NON-SUPPORT	Pathogens		Unknown	Urban Runoff/ storm sewers
Aesthetics	NON-SUPPORT	Trash and debris		Urban Runoff/ storm sewers	

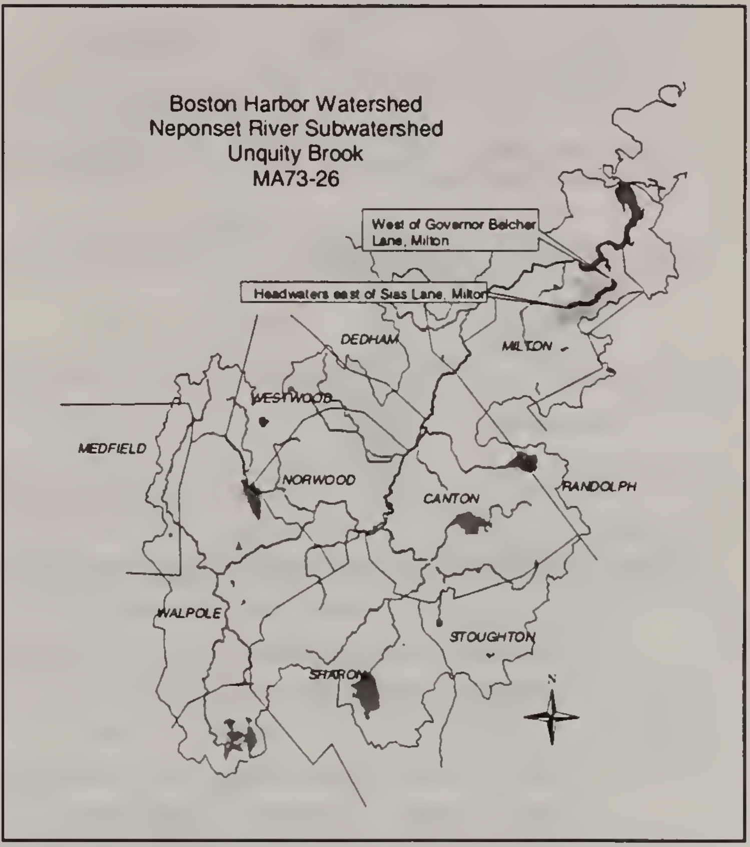
* "Alert Status" issues identified – see *Aquatic Life Use* Assessment

RECOMMENDATIONS NEPONSET RIVER (MA73-03)

- Investigate possible sources of total phosphorus to the Neponset River including point and nonpoint sources of pollution.
- The DWM 1994 benthic macroinvertebrate surveys identified a moderately impacted benthic community. Conduct a biological survey on the Neponset River to determine if water quality has improved and the biota has recovered.
- Conduct additional sediment analyses (metals and toxicity) to determine if the historical contamination is currently impacting water quality and the biota.
- Investigate possible additional sources and continue to monitor pathogen levels in the Neponset River to determine if the ongoing sewer repair projects are effective.
- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious services, and road runoff).
- Conduct a stream cleanup along this segment of the Neponset River.
- Work with the highway departments to implement BMPs to reduce sediment inputs and trash and debris from road crossings.

UNQUITY BROOK (SEGMENT MA73-26)

Location: Isolated (urban): Headwaters east of Sias Lane, west of Randolph Avenue to east of Otis Street, west of Governor Belcher Lane, Milton.
Segment Area: 1.4 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	62%
Open Land	15%
Forest	14%

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO and pathogens (MA DEP 1999a). This segment of Unquity Brook is located within the Fowl Meadow/ Ponkapoag Bog ACEC. In addition, the downstream/tidal portion of Unquity Brook from Adams St. to the confluence with the Neponset River is located within the Neponset River Estuary ACEC (MA DEM August 2000).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II general NPDES storm water permits for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water permit will be issued by December 2002. Permit applications from the towns must be submitted to EPA by March 2003 and coverage begins with the permit application (Scarlet 2001).

During extreme rainfall events the Town of Milton sewer system overflows raw sewage through SSO locations along this segment of Unquity Brook (NepRWA 2002).

USE ASSESSMENT

AQUATIC LIFE

Habitat/Flow

Unquity Brook is an urban interrupted stream that flows from its headwaters under a cemetery, then above ground, to a reach that is entirely dewatered (i.e., streambed is completely drained/dry). The Brook is then culverted and routed underground. When the Brook reappears above ground the streamflow is restricted to a three-foot stone and concrete channel, with no riparian buffer zone. The Brook is again culverted under a street before it then comes above ground to its end.

Chemistry – water

NepRWA conducted bimonthly water quality monitoring in Unquity Brook at three stations, at Randolph Avenue, at Adams Street, and at Squantum Street/Christopher Road, from 1997 to 2001. Samples were analyzed for DO, temperature, pH, TSS, ammonia, and total phosphorus (as P) (NepRWA 1998, 1999, 2001a and b). Based on the field collection techniques (i.e., bucket sampling) the accuracy of these dissolved oxygen data is suspect and therefore are not presented in this assessment report.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=63).

pH

pH ranged between 5.9 and 8.7 SU (n= 59) with eight samples less than 6.5 SU and five greater than 8.5 SU.

Total Suspended Solids

TSS concentrations ranged between BDL and 377 mg/L (n=84) with ten samples above 25 mg/L (nine during wet weather conditions).

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged between 0.002 and 1.61 mg/L (n=76). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.003 and 0.92 mg/L (n=70) with 21 samples greater than 0.1 mg/L.

The *Aquatic Life Use* for Unquity Brook is assessed as partial support based on loss of habitat due to channelization, pH measurement outside the SWQS for a Class B waterbody, and elevated nutrients.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

NepRWA also conducted fecal coliform bacteria sampling in Unquity Brook in conjunction with water quality monitoring (NepRWA 1998, 1999, 2001a and b). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts (n=86) ranged between 0 and 158,000 cfu/100mL (wet weather). During the primary contact season (n=38) 24 counts were greater than 400 cfu/100mL (9 during dry weather). Throughout the year, counts were greater than 4,000 cfu/100mLs on nine occasions with four during dry weather conditions.

Based on the elevated pathogen counts collected during dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

AESTHETICS

NepRWA's water quality sampling indicated instream turbidity during wet weather conditions (NepRWA 1998, 1999, 2001a and b). Large quantities of trash and debris and sedimentation have been identified throughout Unquity Brook (NepRWA 2002).

Based on the prevalence of trash and debris the *Aesthetics Use* for Unquity Brook is assessed as non-support.

Unquity Brook (MA73-26) Use Summary Table

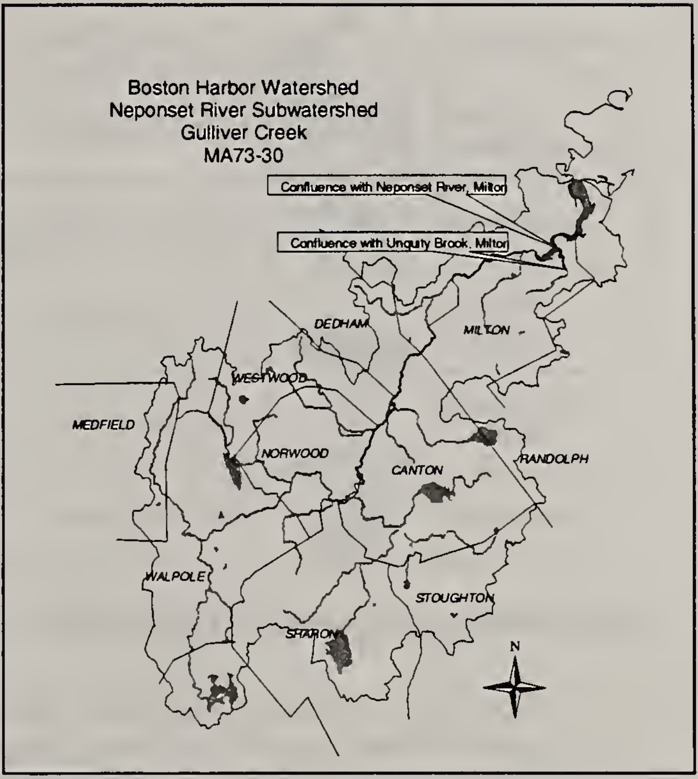
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		PARTIAL SUPPORT	Nutrients, flow alteration, habitat alteration, low pH		Hydromodification, unknown	Urban runoff/storm sewers
Fish Consumption		NOT ASSESSED				
Primary Contact		NON-SUPPORT	Pathogens		Municipal point source (SSO), urban runoff/storm sewers	
Secondary Contact		NON-SUPPORT	Pathogens		Municipal point source (SSO), urban runoff/storm sewers	
Aesthetics		NON-SUPPORT	Trash and debris, siltation		Urban runoff/storm sewers	

RECOMMENDATIONS UNQUITY BROOK (MA73-26)

- Investigate possible sources of total phosphorus to Unquity Brook including point and nonpoint sources of pollution.
- Continue to monitor pathogen levels in Unquity Brook to determine if the ongoing sewer and septic repair projects are effective (e.g., Milton Academy) in reducing fecal coliform levels in Unquity Brook.
- Work with the Town of Milton to continue to eliminate the discharge of raw sewage through sanitary sewer overflow (SSO) locations and to minimize the immediate impacts of these current overflows.
- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious services, and road runoff).
- Conduct a stream cleanup along this segment of the Unquity Brook.
- Work with the municipal highway departments to implement BMPs to reduce sediment inputs and trash and debris from road crossings.

GULLIVER CREEK (SEGMENT MA73-30)

Location: From confluence Unquity Brook to confluence Neponset River, Milton.
Segment Area: 0.02 square miles.
Classification: Class SB.



This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). This segment is located within the Neponset River ACEC (MA DEM August 2000).

The Neponset River once supported substantial American shad and river herring fisheries but obstructions and pollution basically eradicated them. Remnant populations of shad, river herring and rainbow smelt return each spring to the base of the first obstruction, the Baker Chocolate Dam (Milton Lower Falls Dam) in Milton Lower Falls (Brady, 2001). During 1989 and 1990, DMF monitored anadromous rainbow smelt spawning habitat in the Neponset River and Gulliver Creek. Spawning occurred below the Lower Mills Dam and habitat covered approximately 9,495 m^2 (Chase 1996). "The Neponset River contains one of the largest smelt runs in Massachusetts Bay and supports a viable fall and winter recreational fishery along Boston Harbor" (Chase 1996). Chase listed excessive algal growth on substrates, most probably due to nutrient loadings in the river, storm water and NPS discharges leading to sedimentation, and reduced water flow due to withdrawals, as factors affecting smelt spawning in the Neponset River and Gulliver Creek. A feasibility study for dam removal of the Milton Lower Falls Dam and the second obstruction, Tilestone and Hollingsworth Dam is underway. In anticipation of improved access to this system the Division [of Marine Fisheries] has been stocking both American shad and Blueback herring into the Neponset system. Since 1996, over 16,000 Blueback herring and almost 1000 American shad have been transported from other source systems and released into the upper Neponset River in Canton. The Neponset herring fishery is managed under state regulations (Brady, 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH3.0 is prohibited (DFWELE 2000b).

Based on this information the *Shellfishing Use* is assessed as non-support for the entire 0.02 mi^2 of Gulliver Creek.

Gulliver Creek (MA73-30) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED				
Fish Consumption		NOT ASSESSED				
Shellfishing		NON-SUPPORT 0.02 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		NOT ASSESSED				
Secondary Contact		NOT ASSESSED				
Aesthetics		NOT ASSESSED				

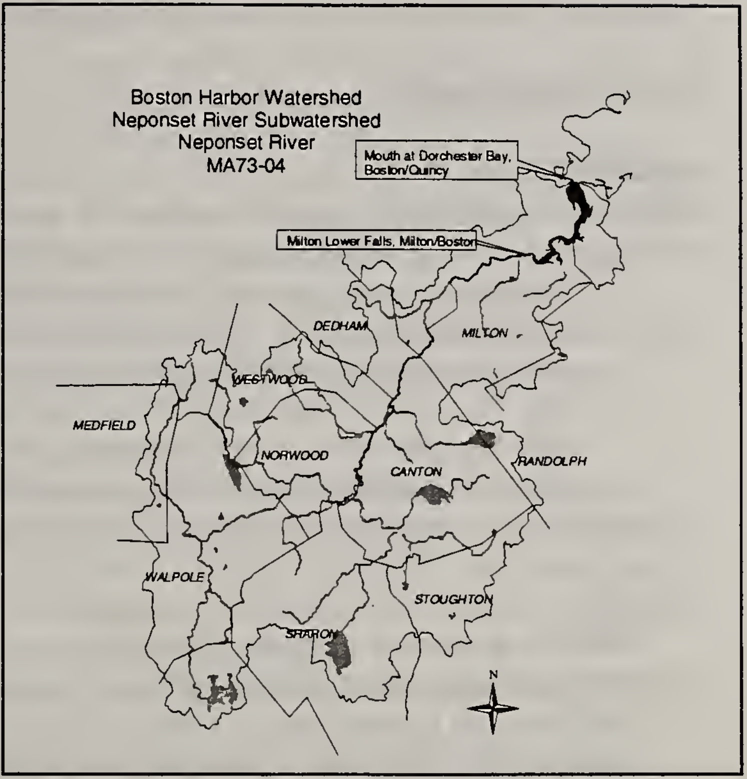
RECOMMENDATIONS GULLIVER CREEK (MA73-30)

- Continue to monitor pathogen levels in Unquity Brook to determine if the ongoing sewer and septic repair projects are effective (e.g., Milton Academy) in reducing fecal coliform levels in Unquity Brook and therefore downstream in Gulliver Creek.

NEPONSET RIVER (SEGMENT MA73-04)

Location: Milton Lower Falls Dam, Milton/Boston to mouth at Dorchester Bay, Boston/Quincy
Segment Area: 1.0 square miles.
Classification: Class SB, Shellfishing (Restricted), CSO*
(*In the updated 2002 SWQS, the CSO designation will be removed from the Neponset River. See Classification section.)

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO, pathogens, turbidity (MA DEP 1999a). This segment of the Neponset River is located within the Neponset River Estuary ACEC (MA DEM August 2000). There is a large (~55 acre) landfill adjacent to the Neponset River on the north west side by Route 93 that has been capped, closed, and turned into Pope John Paul Park (Appendix F).



The Neponset River once supported substantial American shad and river herring fisheries but obstructions and pollution basically eradicated them. Remnant populations of shad, river herring and rainbow smelt return each spring to the base of the first obstruction, the Baker Chocolate Dam (Milton Lower Falls Dam) in Milton Lower Falls (Brady, 2001). During 1989 and 1990, DMF monitored anadromous rainbow smelt spawning habitat in the Neponset River and Gulliver Creek. Spawning occurred below the Lower Mills Dam and habitat covered approximately 9,495 m^2 (Chase 1996). "The Neponset River contains one of the largest smelt runs in Massachusetts Bay and supports a viable fall and winter recreational fishery along Boston Harbor" (Chase 1996). Chase listed excessive algal growth on substrates, most probably due to nutrient loadings in the river, storm water and NPS discharges leading to sedimentation, and reduced water flow due to withdrawals, as factors affecting smelt spawning in the Neponset River and Gulliver Creek. A feasibility study for dam removal of the Milton Lower Falls Dam and the second obstruction, Tilestone and Hollingsworth Dam is underway. Preliminary results indicate that approximately 8,000 cubic yards of contaminated sediments are impounded behind the two dams (ACOE October 31 2001). Discussion of alternate analysis and completion of the feasibility study is ongoing. In anticipation of improved access to this system the Division of Marine Fisheries has been stocking both American shad and blueback herring into the Neponset system. Since 1996, over 16,000 blueback herring and almost 1,000 American shad have been transported from other source systems and released into the upper Neponset River in Canton. The Neponset herring are managed under state Regulations (Brady, 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Wollaston Recreational Facility			31924302	Irrigation Pond and well	0.16	0.06

SURFACE NPDES DISCHARGE SUMMARY:

There were formerly two Boston Water & Sewer CSO outfalls discharging to the Neponset River. Sewer separation work has been completed in these areas and the outfalls have been eliminated as of February 2001.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

MWRA collected water quality samples at six stations between 1996 and 2000 as part of their ongoing receiving water monitoring program (Coughlin 2002):

054- Neponset River at Granite Ave Bridge
042- Neponset River between Neponset and T-Bridge
110- Neponset River, Pine Neck Creek (off Tenean Beach)
122- Neponset River at Port Norfolk Yacht Club Pier
089- Neponset River at Commercial Point (Victory Rd footbridge)
041- Dorchester, Old Colony Yacht Club)

Parameters measured included DO, percent saturation, temperature, and turbidity (Coughlin 2002).

DO

MWRA dissolved oxygen concentrations ranged from 1.02 to 12.54 mg/L with only 41 of the 609 samples less than 0.5 mg/L. Percent saturations ranged between 10.5 and 124.9% with 31 less than 60% and 19 greater than 115% (n=615). Samples were not collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=620).

Turbidity

MWRA turbidity readings ranged between 0 and 34 NTU with an average of 5.65 NTU (n=412).

Historically this segment of the Neponset River has been assessed as non-support for the *Aquatic Life Use* due organic enrichment/low DO, elevated levels of metals in the water column and sediments, and other organics in sediments which were largely attributed to CSO discharges. More recent water quality data suggest improvements in oxygen concentrations, although, low DO levels near the Commercial Point CSO are still detected somewhat frequently (approximately 19% of the samples collected). While water quality conditions appear to be improving with the MWRA CSO elimination program, sediment quality remains a concern; therefore, the *Aquatic Life Use* is unassessed at this time.

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory, the *Fish Consumption Use* is assessed as non-support for this segment of the Neponset River.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH3.0 and GBH3.4 are prohibited (DFWELE 2000b).

Based on this prohibited status of the growing areas, the *Shellfishing Use* is assessed non-support for this entire segment of the Neponset River.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

MWRA collected fecal coliform bacteria samples at their six water quality monitoring stations as part of their ongoing receiving water monitoring program on this segment of the Neponset River (Coughlin 2002). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged from <5 to 1,070,000 cfu/100mL (n=629) with 92 counts greater than 2,000cfu/100mL, 82 greater than 4,000cfu/100mL and 67 counts greater than 10,000cfu/100mL. The highest count was recorded at station 089 (Commercial Point) and was collected during August 1996 in dry weather conditions. During the primary contact season, fecal coliform bacteria counts ranged between <5 to 1,070,000 cfu/100mL with 211 counts greater than 400cfu/100mL (43%). Of the six stations sampled, the highest counts were from station 089 with 68 of the 131 samples greater than 4,000 cfu/100mL (52%).

MWRA collected weekly fecal coliform bacteria samples between 12 June 1996 and 21 September 2000 at three stations at Tenean Beach: MDC26, North; MDC27, Middle; MDC28, South. At these three stations, bacteria counts ranged from <5 to 9,400 cfu/100mL (Coughlin 2001b). Percentages of counts above the *Primary* and *Secondary Recreational Use* guidance are presented below in Table 8.

Table 8. Percentages Of Bacteria Count Above The *Recreational Use* Guidance Collected By MWRA From Three Stations At Tenean Beach

Station	Percent greater than 400 cfu/100mL	Percent greater than 2000 cfu/100mL	Percent greater than 4000 cfu/100mL
MDC26 (n=325)	13%	4%	2%
MDC27 (n=307)	17%	3%	1%
MDC28 (n=315)	17%	5%	2%

Additionally, between 1996 and 2000, MDC issued 100 bathing advisories for Tenean Beach. These advisories were based upon the average fecal coliform bacteria and Enterococcus colony enumerations from three stations along the beach (Coughlin and Stanley 2001).

Based on elevated fecal coliform bacteria counts during wet and dry weather conditions and multiple bathing beach advisories, the *Primary* and *Secondary Contact Recreational uses* are assessed as non-support.

AESTHETICS

Trash and debris have been identified in this segment of the Neponset River including old sunken barges (NepRWA 2002). MWRA collected Secchi disk transparencies from five of their receiving water monitoring stations between 1996 and 2000. Secchi disk depths (n=330) ranged from 0.2 to 6 m with 112 readings less than 1.2m. The disk could be seen all the way to the bottom on 15 occasions.

Based on the evidence of trash and debris and poor water clarity, the *Aesthetics Use* for this segment of the Neponset River is assessed as partial support.

Neponset River (MA73-04) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NON-SUPPORT	Unknown		Unknown	
Shellfishing	For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact	NON-SUPPORT	Pathogens		Urban runoff/ storm sewers, CSOs	
Secondary Contact	NON-SUPPORT	Pathogens		Urban runoff/ storm sewers, CSOs	
Aesthetics	PARTIAL SUPPORT	Trash and debris		Urban runoff/ storm sewers	

RECOMMENDATIONS NEPONSET RIVER (MA73-04)

- Work with NepRWA to conduct a citizen outreach education workshop to educate local residents and landowners about good stream stewardship (i.e., yard waste disposal practices, reduction of impervious services, and road runoff).

- Conduct a stream cleanup along this segment of the Neponset River.

- Work with the highway departments to implement BMPs to reduce sediment inputs and trash and debris from road crossings.

- Work with MWRA to continue to monitor pathogen levels in this segment of the Neponset River to determine if the elimination of the Boston Water & Sewer CSO outfalls and sewer separation projects are effective in reducing fecal coliform bacteria counts.

- Review results of the MWRA's Final 1998 CSO Sediment Synthesis Report.

NEPONSET RIVER SUBWATERSHED - LAKE ASSESSMENTS

A total of 65 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned PALIS code numbers in the Neponset River Subwatershed (Ackerman 1989 and MA DEP 2001b). These lakes represent a total surface area for the Neponset River Subwatershed lakes of 1,922 acres. They range in size from one to 397 acres; 57 lakes are less than 50 acres and five are greater than 200 acres. Information on 33 of the lakes are reported here and stored in the WBS database. The other 32 lakes, which total 184 acres, are unassessed, and they are not currently included as segments in the WBS database.

Lake assessments are based on information gathered during DWM surveys (recent and historic) as well as pertinent information from other reliable sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). The 33 lakes assessed in this report represent 1,738 of the 1,922 or 90% of the acreage in the Neponset River Subwatershed (Figure 17).

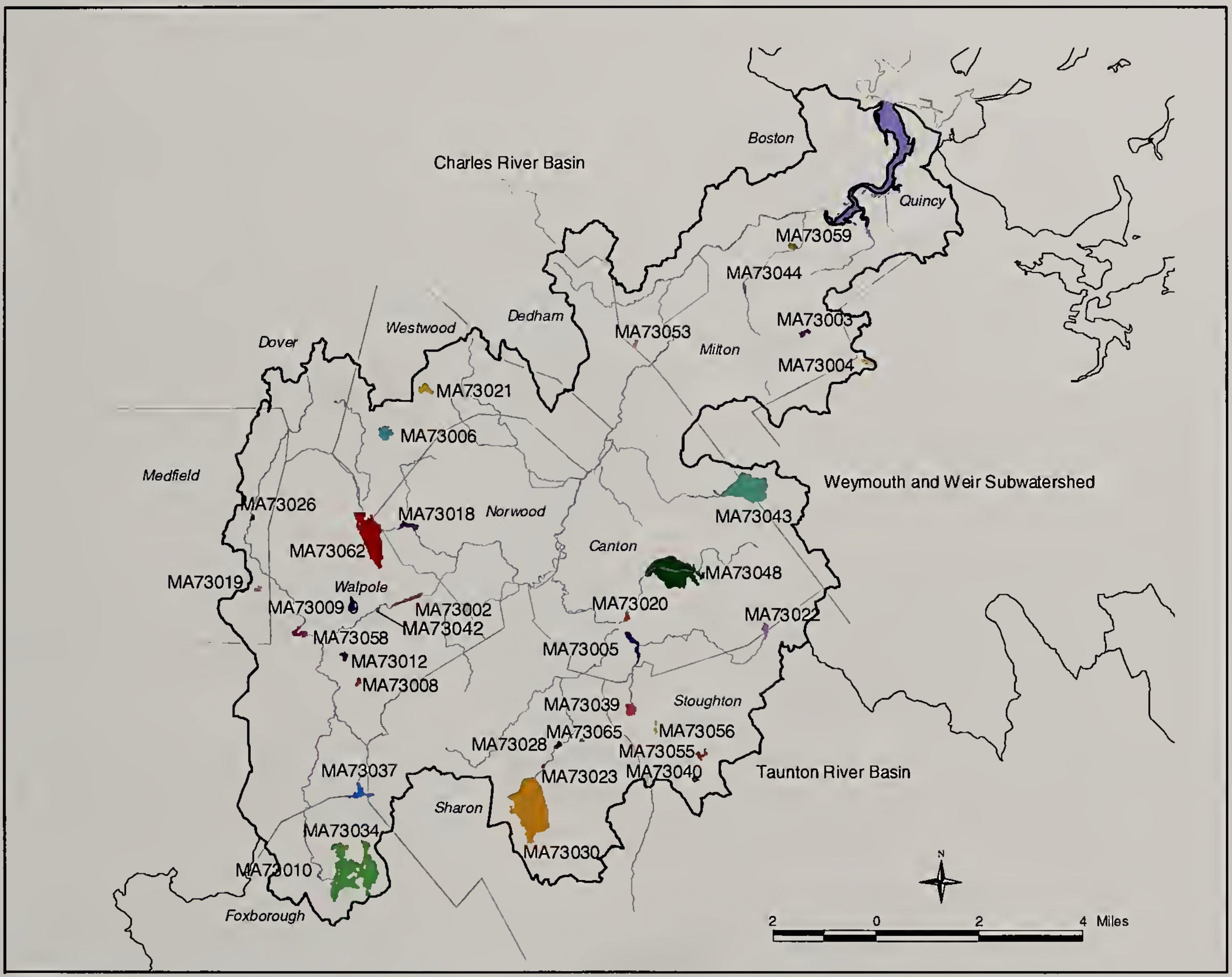


Figure 17. Lake Segments in the Neponset River Subwatershed

The 1994 DWM synoptic surveys focused on visual observations of water quality and quantity (e.g., water level, sedimentation, etc.), the presence of native and non-native aquatic plants (both distribution and areal cover) and presence/severity of algal blooms (Appendix B, Table B2 and B9). During 1999, more intensive in-lake sampling was conducted by DWM in three lakes in the Neponset River basin as part of the TMDL program. This sampling included in-lake measurements of dissolved oxygen, pH, temperature, Secchi disk transparency, nutrients, and chlorophyll *a*, as well as detailed macrophyte mapping (Appendix B, Tables B4 and B6). While these surveys provided additional information to assess the status of the designated uses, fecal coliform bacteria data were unavailable and, therefore, the *Primary Contact Recreational* Use was usually not assessed. In the case of the *Fish Consumption Use*, fish consumption advisory information was obtained from the MDPH (MDPH 2001a).

During the June 1994 DWM synoptic survey it was noted that Plimpton Pond South had been drained. As no new information is available, the use assessments of Plimpton Pond South are not attainable.

The use assessments and supporting information were entered into the EPA WBS database. Data on the presence of non-native plants were entered into an informal DWM non-native plant tracking database.

TROPHIC STATUS EVALUATION

Lakes are dynamic ecosystems that over time undergo a process of succession from one trophic state to another. Under natural conditions most lakes move from a nutrient poor (oligotrophic) condition through an intermediate (mesotrophic) stage of nutrient availability and biological productivity to a nutrient-rich or highly productive (eutrophic) state. For the purposes of this report trophic status was estimated primarily using visual observations of macrophyte cover and phytoplankton populations observed in 1994 by DEP DWM. Occasionally, older data from more detailed diagnostic studies were utilized. A more definitive assessment of trophic status would require more extensive collection of water quality and biological data.

The trophic status estimates for the lakes assessed (total acreage 1,738) in the Neponset River Subwatershed are presented in Table 9. Two lakes were mesotrophic, 14 lakes (13% of the assessed lake acreage) were eutrophic, and one lake was hypereutrophic. The trophic status was undetermined in 17 of the 33 lakes representing 51% of the assessed lake acreage.

Table 9. Neponset River Basin Lake Trophic Status Evaluation (**Bold indicates 1998 303(d) listed**).

Lake	Waterbody Identification Code (WBID)	Class	Size (Acres)	Trophic Status Estimate
Billings Street / East Street Pond, Sharon	MA73065	B	3.0	Eutrophic
Russell Pond (Pine Tree Pond), Milton	MA73003	B	6.0	Eutrophic
Bolivar Pond, Canton	MA73005	B	22.0	Eutrophic
Clark Pond, Walpole	MA73008	B	6.0	Eutrophic
Cobbs Pond, Walpole	MA73009	B	24.0	Eutrophic
Ellis Pond, Norwood	MA73018	B	19.0	Eutrophic
Ganawatte Farm Pond, Walpole / Sharon / Foxborough	MA73037	B	55.0	Eutrophic
Lymans Pond, Westwood	MA73021	B	26.0	Eutrophic
Manns Pond, Sharon	MA73028	B	11.0	Eutrophic
Neponset Reservoir, Foxborough	MA73034	B, WW	268.0	Hypereutrophic
Pinewood Pond, Stoughton	MA73039	B	21.0	Eutrophic
Farrington Pond (Plain Street Pond), Stoughton	MA73040	B	5.0	Eutrophic
Sprague Pond, Boston / Dedham	MA73053	B	13.0	Mesotrophic
Woods Pond (Stoughton Pond), Stoughton	MA73055	B	21.0	Eutrophic
Town Pond, Stoughton	MA73056	B	6.0	Eutrophic
Turner Pond, Walpole	MA73058	B	17.0	Mesotrophic
Turners Pond, Milton	MA73059	B	11.0	Eutrophic

AQUATIC LIFE

The Foxborough Company, a former metal plating and manufacturing company that currently is involved in light manufacturing and electronic assembly, historically discharged process wastewater and sanitary wastewater to the inlet stream of the Neponset Reservoir. The process discharge was connected to the Mansfield WWTP in 1987 and the sanitary discharge was connected in 1989. In 1994, the facility went to a closed-loop system, eliminating its Non-Contact Cooling Water (NCCW) discharge. Neponset Reservoir, headwaters of the Neponset River, received the treated process wastewater discharge from Foxborough Company for many years. This discharge has led to the contamination of the sediments in the reservoir with heavy metals. The reservoir is currently classified by MA DEP as a (4-0011387) Tier 1A, Phase II hazardous waste site.

The May 1998 Phase I investigation Report of the Neponset Reservoir found that cadmium and a number of other metals in the sediments exceeded the Massachusetts Contingency Plan Stage I screening levels that are used to judge if there is potential for exposure (Menzie-Cura & Associates 2001). Because of these findings a Stage II Risk Characterization was performed. DEP approved the Phase II Comprehensive Site Assessment and environmental risk characterization in May of 1998. Through this work the specific constituents of concern were identified (metals, cyanide and volatile organic chemicals). Through four assessment endpoints and associated measurement endpoints the following conclusions were made:

- There was no physical evidence of a continuing release of oil and/or hazardous material to the surface waters which significantly affects Environmental Receptors
- There is no evidence of biologically significant harm associated with current or future exposure of wildlife, fish, shellfish or other aquatic biota to oil and/or hazardous material at or from the site.
- Concentrations of oil and/or hazardous material at or from the disposal site do not and are not likely to exceed any applicable environmental standards
- There is no indication of the potential for biologically significant harm either currently or in the future to Environmental Receptors considering their potential exposures to oil and/or hazardous material and the toxicity of oil and/or hazardous material

A lake management strategy, recommended by the Lake Management Committee and adopted by the Sharon Selectmen, is to control the lake's surface water temperature. This thermally stratified lake typically has summer surface temperatures at or below 83°F. The Town determined that blue green algae responsible for swimmers' ear infections begin to thrive at 85°F. Discharge from the lake is regulated in the summer months to reduce surface temperatures for human health concerns. The Town is required to release 1.7 cfs from the lake for protection of downstream wetlands (ACOE 1998).

Non-native (exotic) aquatic macrophytes were observed in 15 of the 33 lakes surveyed by DWM in 1994 (Appendix B, Table B9). Non-native aquatic macrophyton species observed in the Neponset River Subwatershed lakes included: *Myriophyllum heterophyllum* (variable water milfoil), *Cabomba caroliniana* (fanwort), *Myriophyllum spicatum* (Eurasian water milfoil), *Marsilea quadrifolia* (Pepperwort), *Potamogeton crispus* (curly pond weed), and *Trapa natans (water chestnut)*. These species have high potential for spreading and are likely to have established themselves in downstream lake and river segments in the Neponset River Subwatershed, which may not have been surveyed. Table 10 indicates where these non-native aquatic species were observed (in bold) during the DWM 1994 and/or 1999 surveys and the likely, or potential, avenues of downstream spreading. The *Aquatic Life Use* for these 15 lakes is impaired (partial or non-support) based on the presence of non-native (exotic) aquatic macrophytes.

Two non-native wetland species, *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (reed grass), were identified at 17 (51%) of the 33 lakes surveyed by DWM in 1994 and/or 1999 (Appendix B, Tables B2 and B9). Although the presence of these species is not generally a cause of impairment to lakes, their invasive growth habit can result in the impairment of wetland habitat associated with lakes.

During the 1999 DWM baseline lakes survey of Ganawatte Farm Pond (MA73037) dissolved oxygen concentrations were below two mg/L on all three sampling events (Appendix B, Table B4). Additionally, during the weed mapping survey, dense aquatic plants covered 100% of the water's surface. Ganawatte Farm Pond is assessed as non-support for the *Aquatic Life Use* as a result of organic enrichment/low dissolved oxygen and noxious aquatic plants.

During the DWM 1999 surveys dissolved oxygen concentrations at the bottom of Turners Pond (MA73059) were less than 0.2 mg/L and surface waters were supersaturated (>115% saturation). In six of the eight samples analyzed for total phosphorus (as P) the levels were greater than 0.5 mg/L. The *Aquatic Life Use* for Turners Pond is assessed as non-support due to organic enrichment/low dissolved oxygen, high levels of nutrients, and high turbidity.

Water quality sampling in Cobbs Pond in 1999 indicated elevated nutrient concentrations and evidence of organic enrichment including dense cover of aquatic plants (Appendix B, Tables B6 and B9). The *Aquatic Life Use* was, therefore, assessed as non-support for the entire 24 acres of Cobbs Pond.

Although the causes of impairment to the above three ponds are unknown, urban runoff /storm water is suspected.

Table 10. Non-Native (Exotic) Aquatic Plant Species Locations (**In Bold**) In The Neponset River Subwatershed And Their Possible Paths Of Downstream Spreading (Appendix B, Table B9).

Cabomba caroliniana **(Fanwort)**

Bolivar Pond (Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/Canton/Dedham)

Ellis Pond (Norwood) ⇒ Hawes Brook (through a small unnamed pond) ⇒ Neponset River (through the Neponset River Reservation, Milton/Canton/Dedham)

Manns Pond (Sharon) ⇒ Massapoag Brook (through Trowel Shop Pond, Sharon, Shepard Pond, Canton, and a small unnamed pond, Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/ Canton/Dedham)

Town Pond (Stoughton) ⇒ unnamed tributary (through an unnamed pond, Stoughton) ⇒ Steep Hill Brook ⇒ Bolivar Pond (Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/ Canton/Dedham)

Turner Pond (Walpole) ⇒ unnamed tributary ⇒ Neponset River (through Stetson Pond, Plimpton Pond, and Bird Pond, Walpole, and the Neponset River Reservation, Milton/Canton/Dedham)

Myriophyllum heterophyllum **(Variable water milfoil)**

Billings St./East St. Pond (Sharon) ⇒ unnamed tributary ⇒ Massapoag Brook (through Trowel Shop Pond, Sharon, Shepard Pond, Canton, and a small unnamed pond, Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/ Canton/Dedham)

Clark Pond (Walpole) ⇒ unnamed tributary ⇒ Diamond Pond (Walpole) ⇒ unnamed tributary ⇒ Memorial Pond (Walpole) ⇒ unnamed tributary ⇒ Neponset River (through Stetson Pond, Plimpton Pond, and Bird Pond, Walpole, and the Neponset River Reservation, Milton/Canton/Dedham)

Farrington Pond (Stoughton) ⇒ unnamed tributary ⇒ another unnamed tributary (through an unnamed pond, Stoughton) ⇒ Town Pond (Stoughton) ⇒ unnamed tributary (through an unnamed pond, Stoughton) ⇒ Steep Hill Brook ⇒ Bolivar Pond (Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/ Canton/Dedham)

Neponset Reservoir (Foxborough) ⇒ unnamed tributary ⇒ Crackrock Pond (Foxborough) ⇒ Neponset River (through several small unnamed ponds; Stetson Pond, Plimpton Pond, and Bird Pond, Walpole; and the Neponset River Reservation, Milton/Canton/Dedham)

Ponkapoag Pond (Canton) ⇒ unnamed tributary (through a small unnamed pond) ⇒ Neponset River (through the Neponset River Reservation, Milton/Canton/Dedham)

Myriophyllum spicatum **(Eurasian water milfoil)**

Ponkapoag Pond (Canton) ⇒ unnamed tributary (through a small unnamed pond) ⇒ Neponset River (through the Neponset River Reservation, Milton/Canton/Dedham)

Marsilea quadrifolia **(Pepperwort)**

Manns Pond (Sharon) ⇒ Massapoag Brook (through Trowel Shop Pond, Sharon, Shepard Pond, Canton, and a small unnamed pond, Canton) ⇒ Forge Pond (Canton) ⇒ East Branch ⇒ Neponset River (through the Neponset River Reservation, Milton/ Canton/Dedham)

Trapa natans **(Water chestnut)**

Clark Pond (Walpole) ⇒ unnamed tributary ⇒ Diamond Pond (Walpole) ⇒ unnamed tributary ⇒ Memorial Pond (Walpole) ⇒ unnamed tributary ⇒ Neponset River (through Stetson Pond, Plimpton Pond, and Bird Pond, Walpole, and the Neponset River Reservation, Milton/Canton/Dedham)

FISH CONSUMPTION

The MDPH fish consumption advisory list contains the status of each waterbody for which an advisory has been issued. If a water body is not on the list, it may be because either an advisory was not warranted or the water body has not been sampled. MDPH's most current Fish Consumption Advisory list is available online at http://www.state.ma.us/dph/beha/fishlist.htm.

The MDPH Fish Consumption List includes three ponds in the Neponset River Subwatershed: Bird, Plimpton, and Willet ponds.

Bird and Plimpton ponds are impoundments of the Neponset River between the Hollingsworth & Vose Dam in Walpole and the Tilestone Dam in Boston (Hyde Park). The advisories, issued due to elevated levels of PCBs in fish tissue, recommend the following (MDPH 2001a):

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any brown bullhead from the Neponset River.
2. The general public should limit consumption of brown bullhead from Neponset River to two meals per month.

The *Fish Consumption Use* for Bird Pond is assessed as non-support due to elevated levels of PCBs in fish tissue.

In July and August 1994 fish toxics monitoring (metals, PCB, and organochlorine pesticide in edible fillets) was conducted by DWM in Willet Pond. These data are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.* 1995). Because of elevated mercury concentrations, MDPH issued a fish consumption advisory for Willet Pond recommending the following (MDPH 2001a):

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any largemouth bass from Willet Pond.
2. The general public should limit consumption of largemouth bass from Willet Pond to two meals per month.

Willet Pond in Walpole/Norwood/Westwood, and Bird Pond in Walpole are impaired (non-support) for the *Fish Consumption Use* (Table 11).

In July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age" (MDPH 2001b).

Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury" (MDPH 2001b).

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. The advisory encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* for lakes in the Neponset River Basin cannot be assessed as support or partial support.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

All three lakes surveyed by DWM in the Neponset River Subwatershed in 1999 exceeded the Secchi disk depth bathing beach criterion (Appendix B, Table B6). In the absence of fecal coliform bacteria and Secchi disk depth data in other lakes the assessment of the recreational uses was based primarily on the synoptic survey information described above. Depending upon the severity of these conditions the recreational and aesthetics uses were assessed as either partial or non-support. Where no objectionable conditions were noted the *Primary Contact Recreational Use* was not assessed due to the lack of fecal coliform bacteria data.

No lakes in the Neponset River Basin were assessed as supporting the *Primary Contact Recreational Use*. The *Primary Contact Recreational Use* was impaired (partial or non-support) for the seven lakes (408 acres; 23% of the total acreage) assessed in the Neponset River Subwatershed (Table 11). Causes of impairment included noxious/overabundant plant growth (native and/or non-native {exotic} vegetation) and turbidity. Due to the lack of current available data (i.e., plant surveys and fecal coliform bacteria data), the *Primary Contact Recreational Use* was not assessed for the remaining 26 lakes (a total of 1,330 acres).

The *Secondary Contact Recreational* and *Aesthetics* uses were assessed as support in only one pond in the Neponset River Subwatershed (Turners Pond, Milton). Six of the assessed lakes (Table 11) had a high degree/density of macrophyte or algae cover that resulted in the *Secondary Contact Recreational* and *Aesthetic* uses being impaired (partial or non-support). These uses were not assessed for 25 lakes (1,303 acres).

SUMMARY

A total of 21 of the 33 lakes (63%) assessed in the Neponset River Subwatershed were impaired for one or more uses (Table 11). Causes of impairment included noxious (overabundant) plant growth (including both native and non-native {exotic} vegetation), mercury contamination, PCB contamination, organic enrichment/low dissolved oxygen, and turbidity. No lakes supported all uses nor were any assessed as support for either the *Aquatic Life* or *Primary Contact Recreational* uses. Nine lakes are currently not assessed for any use (Table 11).

With the exception of mercury and PCBs, these causes may reflect symptoms of lake eutrophication, a process of enrichment from excessive plant nutrients. Site-specific sources of impairment to the lakes in the Neponset River Subwatershed are largely unknown. However, nutrient enrichment from storm water runoff and failing/substandard sewage disposal systems are likely to have increased the macrophyte productivity resulting in impairments to the *Aquatic Life*, *Recreational,* and *Aesthetics* uses.

RECOMMENDATIONS – LAKES

- Coordinate with DEM and/or other groups conducting lake surveys to generate quality assured lakes data. Conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds, they should be eliminated or, at least minimized through the application of appropriate point or non-point source control techniques.

- For non-native aquatic or wetland plant species that are isolated to one or a few location(s), quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations (Table 5 and/or Table 10), to determine the extent of the infestation. Also, "spot" treatments (refer to the draft Generic Environmental Impact Report for Eutrophication and Aquatic Plant Management in Massachusetts [Mattson et al, 1998] for advantages and disadvantages) should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand-pulling individual plants in small areas. In larger areas, other techniques such as selective herbicide application may be necessary. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These cautions will minimize the spreading of the populations. This draft aquatic plant report (Mattson et al, 1998) should be consulted prior to the development of any lake management plan to control non-native aquatic or wetland plant species.

- As with the isolated cases, a program to manage the more extensive plant infestations should include additional monitoring efforts to determine the extent of the problem. The draft Generic Environmental Impact Report for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et al, 1998) should be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for these plants to reproduce and spread vegetatively (from cuttings).

- Another important component of a management plan is prevention of further spreading of these plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations occurring in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

- Implement recommendations identified in the TMDLs and lake Diagnostic/Feasibility studies, including lake watershed surveys to identify sources of impairment.

- Investigate the downstream spread of the non-native *Myriophyllum heterophyllum* (variable water milfoil) in the following lakes: **Billings St./East St. Pond, Clark Pond, Neponset Reservoir, Ponkapoag Pond**

- Review data from “Beaches Bill” required water quality testing (bacteria sampling from all formal bathing beaches) to assess the status of the recreational uses; e.g., Blue Hills Pond (Milton), Massapoag Pond (Sharon), and Billings Street Pond (Sharon).

- The Memorial Pond Section 319 Phase I Restoration Project is part of a larger project to rehabilitate Memorial Pond in Walpole. This project will construct storm water BMPs at Stone Street and East and Diamond Streets which were identified in *Memorial Pond Investigation and Management Plan (1999)* as major sources of sediments and nutrients. A planned dredging project will remove sediments and nuisance aquatic vegetation and the outlet to the pond will be rebuilt to allow future drawdowns to control nuisance aquatic vegetation. Track progress of the Memorial Pond 319 Phase I Restoration Project.

Table 11. Neponset River Subwatershed Lake Assessments (**Bold indicates 1998 303(d) listed**).

LAKE	Waterbody Identification Code WBID	SIZE Acres	Aquatic Life *Causes*	Fish Consumption *Causes*	Primary Contact *Causes*	Secondary Contact *Causes*	Aesthetics *Causes*
Bird Pond, Walpole	MA73002	25.0	Not Assessed	NON-SUPPORT *PCBs*	Not Assessed	Not Assessed	Not Assessed
Russell Pond (Pine Tree Pond), Milton	MA73003	6.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Blue Hills Reservoir, Quincy	MA73004	14.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Bolivar Pond, Canton	MA73005	22.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Buckmaster Pond, Westwood	MA73006	27.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Clark Pond, Walpole	MA73008	6.0	NON-SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Cobbs Pond, Walpole	MA73009	24.0	NON-SUPPORT *Organic Enrichment* *Low D.O.* *Nutrients*	Not Assessed	NON-SUPPORT *Noxious Aquatic Plants* *Turbidity*	NON-SUPPORT *Noxious Aquatic Plants*	NON-SUPPORT *Noxious Aquatic Plants*
Crackrock Pond, Walpole	MA73010	14.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Memorial Pond (Diamond Pond), Walpole	MA73012	7.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Ellis Pond, Norwood	MA73018	19.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Flynns Pond, Medfield	MA73019	8.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Forge Pond, Canton	MA73020	25.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Lymans Pond, Westwood	MA73021	26.0	Not Assessed	Not Assessed	NON-SUPPORT *Noxious Aquatic Plants*	NON-SUPPORT *Noxious Aquatic Plants*	NON-SUPPORT *Noxious Aquatic Plants*
Glen Echo Pond, Canton/Stoughton	MA73022	16.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Hammer Shop Pond, Sharon	MA73023	4.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Jewells Pond, Medfield	MA73026	3.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed

Table 11. (Continued) Neponset River Subwatershed Lake Assessments (**Bold indicates 1998 303(d) listed**).

LAKE	Waterbody Identification Code WBID	SIZE Acres	Aquatic Life *Causes*	Fish Consumption *Causes*	Primary Contact *Causes*	Secondary Contact *Causes*	Aesthetics *Causes*
Manns Pond, Sharon	MA73028	11.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Massapoag Pond, Sharon	MA73030	397.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Neponset Reservoir, Foxborough	MA73034	268.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	NON-SUPPORT *Exotic Species* *Turbidity*	NON-SUPPORT *Exotic Species*	NON-SUPPORT *Exotic Species* *Turbidity*
Ganawatte Farm Pond, Walpole/Sharon/ Foxborough	MA73037	55.0	NON-SUPPORT *Organic Enrichment* *Low D.O.* *Noxious Aquatic Plants*	Not Assessed	Non-Support *Noxious Aquatic Plants* *Turbidity*	Non-Support *Noxious Aquatic Plants*	Non-Support *Noxious Aquatic Plants* *Turbidity*
Pinewood Pond, Stoughton	MA73039	21.0	NON-SUPPORT *Exotic Species*	Not Assessed	NON-SUPPORT *Exotic Species*	NON-SUPPORT *Exotic Species*	NON-SUPPORT *Exotic Species*
Plain Street Pond, (Farrington Pond) Stoughton	MA73040	5.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Plimpton Pond South, Walpole	MA73042	5.0	Not Attainable	Not Attainable	Not Attainable	Not Attainable	Not Attainable
Ponkapoag Pond, Canton	MA73043	203.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Popes Pond, Milton	MA73044	13.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Reservoir Pond, Canton	MA73048	243.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Sprague Pond, Boston/Dedham	MA73053	13.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Stoughton Pond, (Woods Pond) Stoughton	MA73055	21.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Town Pond, Stoughton	MA73056	6.0	PARTIAL SUPPORT *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed

Table 11. (Continued) Neponset River Subwatershed Lake Assessments (**Bold indicates 1998 303(d) listed**).

LAKE	Waterbody Identification Code WBID	SIZE Acres	Aquatic Life *Causes*	Fish Consumption *Causes*	Primary Contact *Causes*	Secondary Contact *Causes*	Aesthetics *Causes*
Turner Pond, Walpole	MA73058	17.0	PARTIAL SUPPORT *Noxious Aquatic Plants* *Exotic Species*	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Turners Pond, Milton	MA73059	11.0	NON-SUPPORT *Organic Enrichment* *Low DO* *Nutrients*	Not assessed	PARTIAL SUPPORT *Turbidity*	SUPPORT	SUPPORT
Willet Pond, Walpole/Westwood/ Norwood	MA73062	200.0	Not Assessed	NON-SUPPORT *Mercury*	Not Assessed	Not Assessed	Not Assessed
Billings Street/ East Street Pond, Sharon	MA73065	3.0	NON-SUPPORT *Exotic Species*	Not Assessed	NON-SUPPORT *Exotic Species*	NON-SUPPORT *Exotic Species*	NON-SUPPORT *Exotic Species*

WEYMOUTH AND WEIR SUBWATERSHED- RIVER AND ESTUARY SEGMENT ASSESSMENTS

Furnace Brook (Segment MA74-10) 192
Trout Brook (Segment MA74-12) 193
Cochato River (Segment MA74-06) 194
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Monatiquot River (Segment MA74-08) 198
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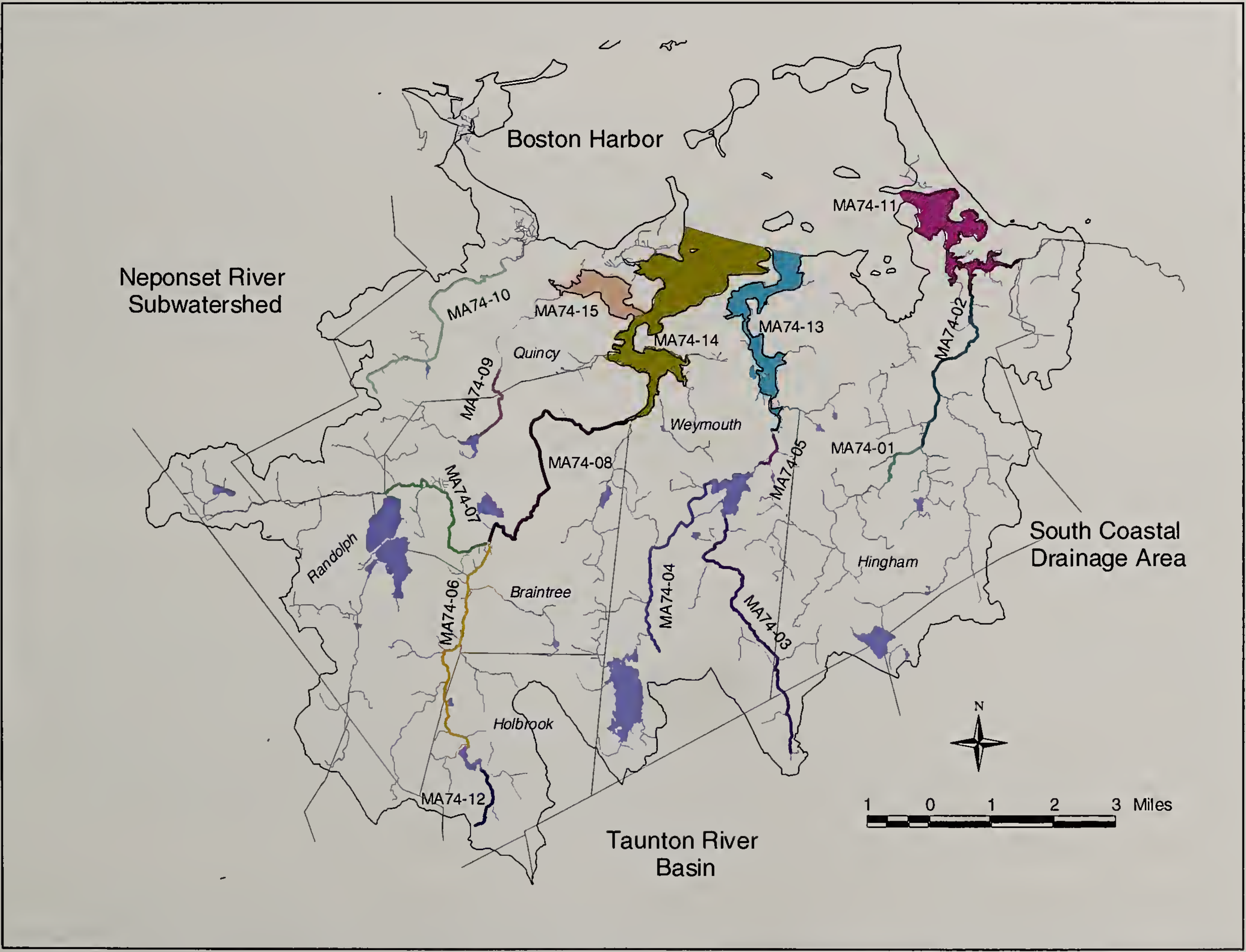


Figure 18. River/Estuarine Segments in the Weymouth and Weir Subwatershed

ISSUES AND RECOMMENDATIONS PERTINENT TO THE WEYMOUTH AND WEIR SUBWATERSHED

Water quantity is an important issue throughout the Boston Harbor Watershed. The majority of public water, whether from local supplies or through the interbasin transfer of water from Quabbin Reservoir in central Massachusetts by the MWRA, is processed at the MWRA's Deer Island Wastewater Treatment Plant and discharged to Massachusetts Bay. Recharge of the local systems is mainly limited to precipitation events and low streamflow is a serious problem. This loss of water essentially reduces available streamflow, and threatens instream uses such as aquatic life, habitat quality and quantity and recreational uses. Strong conservation measures through implementation strategies such as block rate pricing, installation of water- saving devices in homes and public buildings, in concert with a strong educational program, will all help reduce the stress placed on the water resources throughout the Boston Harbor Watershed.

Sanitary sewer overflows have been a chronic problem in the Weymouth Fore River and Back River watersheds contributing to violations of water quality standards, particularly during periods of high groundwater after rain events. These overflows have been in areas of public water supplies, shellfish beds, and bathing beaches. The overflows have occurred from the municipal sewer systems, as well as the MWRA interceptor system serving the communities on the South Shore. The primary causes of the sewer overflows are hydraulic deficiencies in the MWRA system and the municipal systems, excessive amounts of infiltration and inflow getting into the municipal systems, and poor operation and maintenance of the municipal systems (Chretien 2002).

Under the Title 5 Program, the Commonwealth has developed three programs to assist homeowners with wastewater management problems. The Homeowner Septic Loan Program provides low interest loans to homeowners to upgrade systems that will not pass Title 5 inspections. The Comprehensive Community Septic Management Program provides betterment loans to communities to target known or suspected failures or to develop a community-wide management plan. The third option allows homeowners to claim tax credits for septic upgrades. Additional information about the Title 5 Program is available online from the MA DEP website http://www.state.ma.us/dep/brp/wwm/T5pubs.htm#add. In the Weymouth and Weir Subwatershed, the towns of Hingham, Holbrook, and Weymouth have participated in the Comprehensive Community Septic Management Program (Chesebrough 2002).

The communities of Weymouth, Braintree, Holbrook, Randolph, and Hingham obtain their water from within the watershed. These communities are virtually at the capacity or above the capacity of their existing water supply sources (Chretien 2002).

DEP issued an ACO to the Town of Weymouth for exceeding limits on permitted water withdrawals. With DEP oversight and assistance, the Town has reduced unaccounted-for water and instituted water conservation measures, as required by the Order. After investigations of alternatives were performed for additional capacity, as required by the Order, the Town was able to obtain a Water Management Act Permit for the reactivation of Winter Street Well #1. The well has the potential of increasing their water supply capacity by 0.43 MGD above the existing town-wide capacity of 4.5 MGD. Weymouth is also approved to connect the Libbey Park Well with an approved capacity of 0.39 MGD to the Bilodeau Water Treatment Plant, which will improve the Town's ability to reliably provide sufficient and higher quality water to meet demand. Weymouth, with the cooperation of MWRA, will also be establishing an emergency connection to the MWRA water distribution system (Chretien 2002).

Braintree-Randolph-Holbrook Tri-Town Water District, with DEP approval, is performing dredging of 1.4 million cubic yards of material from the Great Pond Reservoir to increase water supply storage capacity for an additional 30 days (Chretien 2002).

Mass. American Water Co., providing water to the Town of Hingham, signed an Administrative Consent Order with Penalty with the DEP in 1999 and as a result of DEP oversight has reduced unaccounted-for water from 26% to 13%. Mass. American has also provided for the establishment of a stream gage to better monitor the impact of their withdrawals on the Weir River (Chretien 2002).

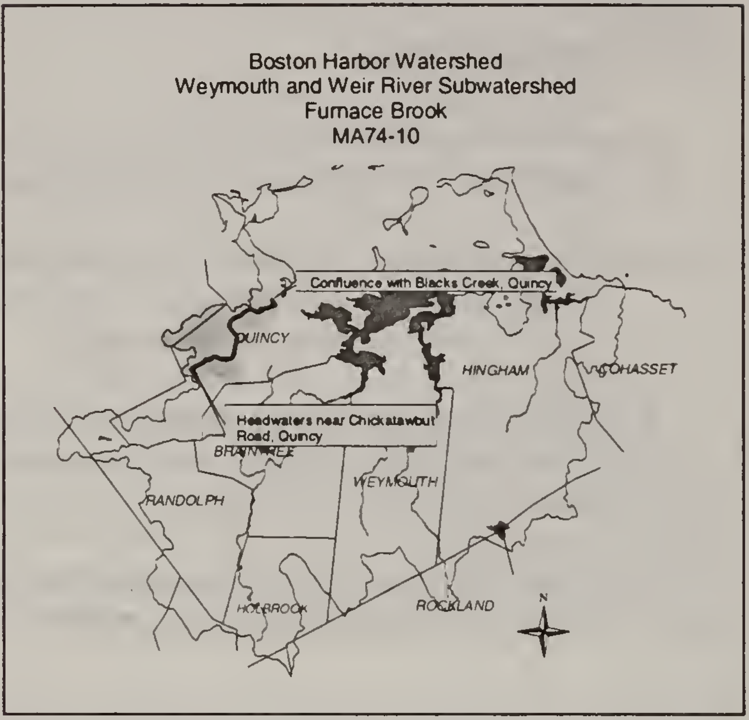
Black Rock Golf Community, Hingham, MA, received a Water Management Act Permit Approval in June 2001. The four irrigation wells are located in the former Hingham Crushed Stone Quarry, in the Plymouth River segment of the Weir River sub-basin. The development is presently under construction; no water withdrawal has occurred to date (O'Keefe 2002).

RECOMMENDATIONS

- Collect quality assured water quality, bacteria, and biological data to assess the designated uses of rivers and estuaries in the Weymouth and Weir Subwatershed.
- Work with the Fore River Watershed Association to develop a QAPP for their future water quality monitoring data. Continue to review the Fore River Watershed Association fish count and water quality data as it becomes available.
- Continue to monitor for fecal coliform bacteria to determine if the Braintree, Weymouth, and MWRA sewer projects aimed at reducing the number of sanitary sewer overflows to this subwatershed are effective.
- Determine the status of the septic system repairs being implanted under the Title 5 program in Hingham, Holbrook, and Weymouth.

FURNACE BROOK (SEGMENT MA74-10)

Location: From headwaters north of Blue Hills Reservoir, Quincy to confluence with Blacks Creek, Quincy.
Segment Area: 2.7 miles.
Classification: Class B.


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Furnace Brook
MA74-10
Confluence with Blacks Creek, Quincy
QUINCY
HINGHAM
COHASSET
Headwaters near Chickatawbut Road, Quincy
BRAINTREE
WEYMOUTH
RANDOLPH
HOLBROOK
ROCKLAND
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	40%
Forest	33%
Open Land	9%

This segment is on the 1998 303(d) list of impaired waters needing confirmation for organic enrichment/ low DO (MA DEP 1999a).

During 1992 and 1993, DMF monitored anadromous rainbow smelt spawning habitat in Furnace Brook, Quincy. Smelt were found to deposit eggs in one small stretch of the brook from Hancock Street Bridge to the interface of fresh and intertidal habitat (Chase 2000). Results indicated that in comparison to similar size spawning runs in the Boston Harbor region, the run in Furnace Brook is below capacity (Chase 2000). Possible explanations include degradation of habitat due to storm water runoff and the narrow tide gate opening at Quincy Bay that may limit adult attraction and passage.

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Furnace Brook (MA74-10) Use Summary Table

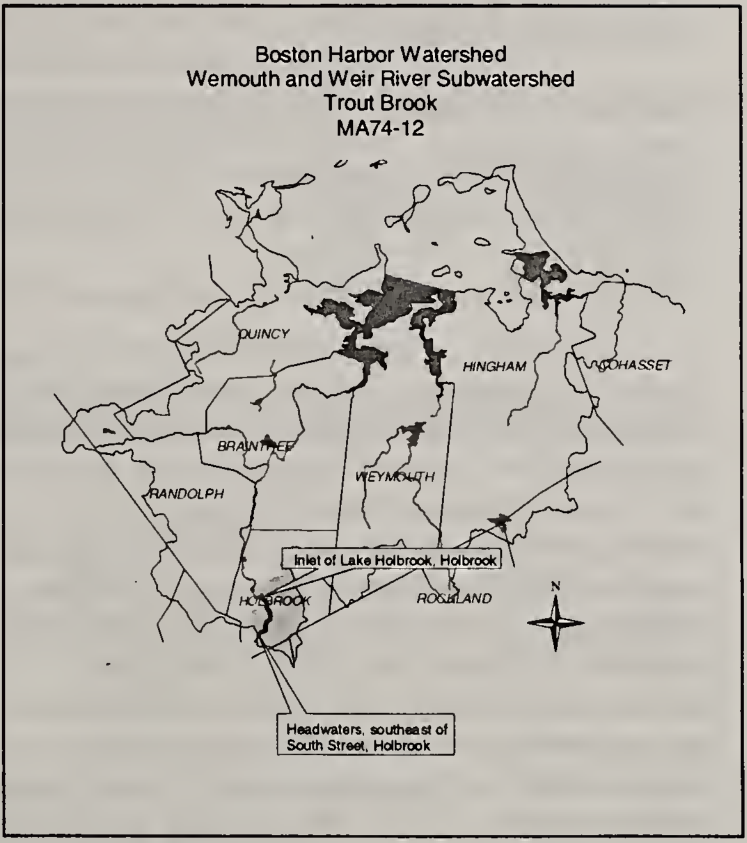
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

TROUT BROOK (SEGMENT MA74-12)

Location: Headwaters, southeast of South Street, Holbrook, to inlet of Lake Holbrook, Holbrook.
Segment Area: 3.9 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	52%
Residential	36%
Open Land	7%


Boston Harbor Watershed
Wemouth and Weir River Subwatershed
Trout Brook
MA74-12
QUINCY
HINGHAM
COHASSET
BRAINTREE
WEYMOUTH
RANDOLPH
Inlet of Lake Holbrook, Holbrook
HOLBROOK
ROCKLAND
N
Headwaters, southeast of South Street, Holbrook

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Randolph/ Holbrook Joint Water Board	3244001		31913301	04G	3.27*	3.86

* System-wide withdrawal

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Trout Brook (MA74-12) Use Summary Table

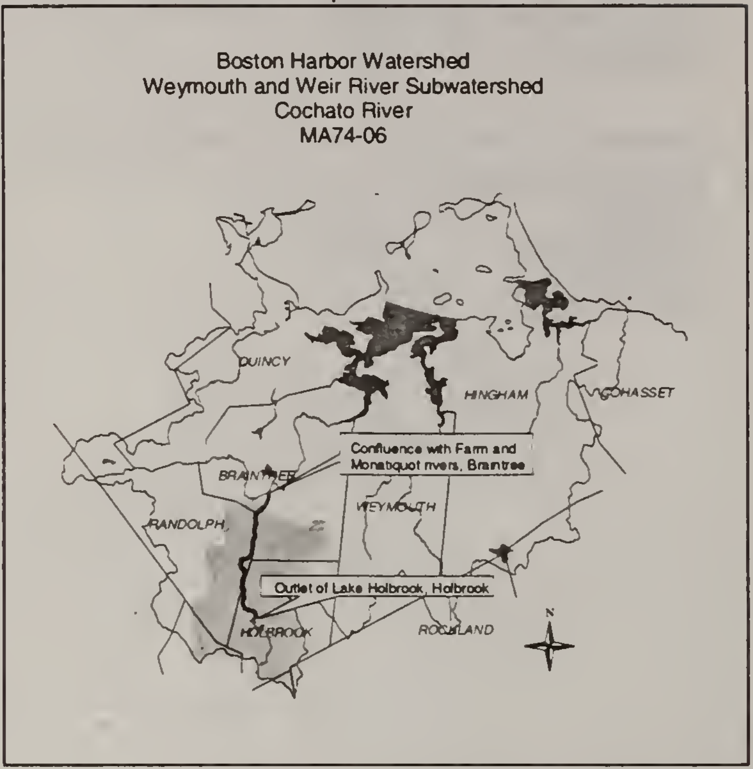
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

COCHATO RIVER (SEGMENT MA74-06)

Location: Outlet Lake Holbrook, Holbrook to confluence with Farm and Monatiquot rivers, Braintree.
Segment Area: 4 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	42%
Forest	38%
Open Land	9%


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Cochato River
MA74-06
QUINCY
HINGHAM
COHASSET
Confluence with Farm and Monatiquot rivers, Braintree
BRAINTREE
WEYMOUTH
RANDOLPH
Outlet of Lake Holbrook, Holbrook
HOLBROOK
ROCKLAND
N

This segment is on the 1998 303(d) list of impaired waters for pesticides, organic enrichment/ low DO, and pathogens (MA DEP 1999a). The Baird & McGuire Superfund Site, located approximately 500 feet west of the Cochato River on South Street near the Holbrook/Randolph line, was a former chemical manufacturing and batching facility. Activities included mixing, packaging, storing and distribution of various products, including herbicides, pesticides, disinfectants, soaps, floor waxes, and solvents. The groundwater at the Baird & McGuire Site is contaminated with pesticides and organic and inorganic chemicals. Studies found significant levels of volatile organic compounds (VOCs), other organic compounds, arsenic, and pesticides including DDT and chlordane in Cochato River sediments. The groundwater discharge is believed to be partially responsible for contamination of Cochato River sediments and adjoining wetlands. A total of 4,712 cubic yards of contaminated sediment were removed from the river. Annual sampling of the river sediments and five year sampling of fish in the river and in Sylvan Lake will continue for 30 years to ensure that contaminant levels do not increase. Frequency of sampling may decrease after year five if contaminant levels decrease significantly (MA DEP 13 November 1998).

The Holbrook Conservation Commission maintains the Lake Holbrook Dam, located along this river segment. The use assessments for Lake Holbrook, Sylvan Lake and Ice House Pond are provided in the Lakes section of this assessment report (Table 12).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Braintree Municipal Golf Course		9P31904001		Irrigation Pond	0.05	0.05

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

FISH CONSUMPTION

MDPH issued a fish consumption advisory for the Cochato River, including Ice Pond and Sylvan Lake, due to elevated levels of pesticides in fish tissue. The advisory recommends the following:

1. Children younger than 12-years, pregnant women, and nursing mothers, should not consume any fish from the Cochato River, including Ice Pond and Sylvan Lake.
2. The general public should not consume any brown bullhead (*Ameiurus nebulosus)*, carp (*Cyprinus* carpio), and/or American eel (*Anguilla rostrata*) from the Cochato River, including Ice Pond and Sylvan Lake.
3. The general public should limit consumption of non-affected fish species (see above) from this waterbody to two meals per month.

Based on the MDPH site-specific fish consumption advisory, this segment is assessed as non-support for the *Fish Consumption Use.*

Cochato River (MA74-06) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED				
Fish Consumption		NON-SUPPORT	Pesticides		Unknown	
Primary Contact		NOT ASSESSED				
Secondary Contact		NOT ASSESSED				
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS COCHATO RIVER (MA74-06)

- As it becomes available, review sediment and fish data from the Baird & McGuire Superfund assessments to determine possible long-term impacts to aquatic life.

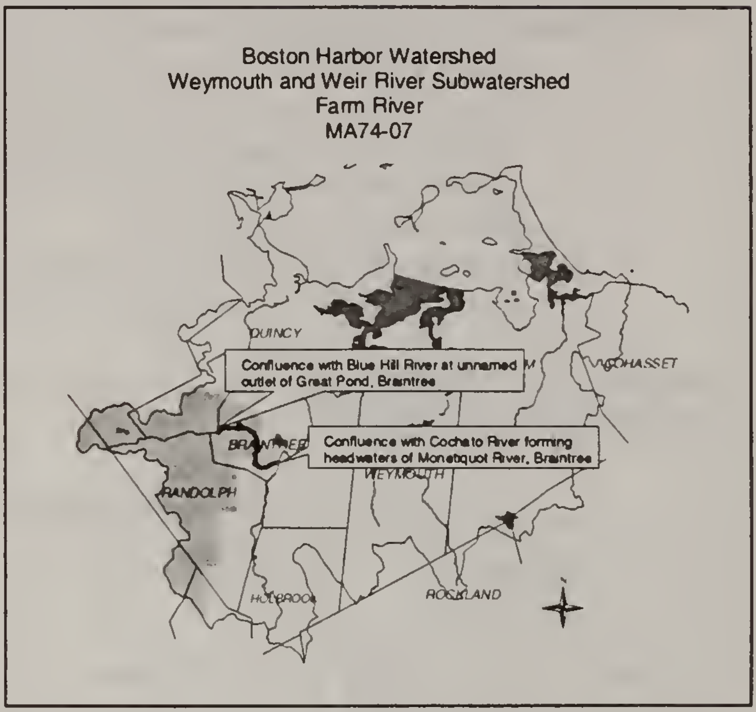
FARM RIVER (SEGMENT MA74-07)

Location: From confluence with Blue Hill River at unnamed outlet of Great Pond, Braintree to confluence with Cochato River forming headwaters of Monatiquot River, Braintree.
Segment Area: 2.7 miles.
Classification: Class B

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	42%
Residential	26%
Industrial	9%

The use assessment for Hoosicwhisick Pond is provided in the Lakes section of this assessment report (Table 12).


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Farm River
MA74-07
QUINCY
Confluence with Blue Hill River at unnamed outlet of Great Pond, Braintree
COHASSET
BRAINTREE
Confluence with Cochato River forming headwaters of Monatiquot River, Braintree
WEYMOUTH
RANDOLPH
HOLBROOK
ROCKLAND

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Randolph/ Holbrook Joint Water Board	3244001		31913301	01S Great Pond	3.27	3.86
Braintree Water and Sewer Department	3040000		31904001	01S Great Pond (lower) 02S Richardi Reservoir 03S Farm River 04S Upper Reservoir	3.87	3.35

For three weeks during the months of June, July, August, and September, up to 80% of the flow of the Farm River may be diverted to Richardi Reservoir where it is then pumped to Great Pond for use by the Braintree Water and Sewer Department for the municipal supply of Braintree, Randolph and Holbrook. The amount of water pumped from Richardi Reservoir to Great Pond Reservoir varies from year to year. 310 million gallons were pumped from Richardi to Great Pond in 2000, representing approximately 10% of the water withdrawn from Great Pond (Jean 2002).

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Farm River (MA74-07) Use Summary Table

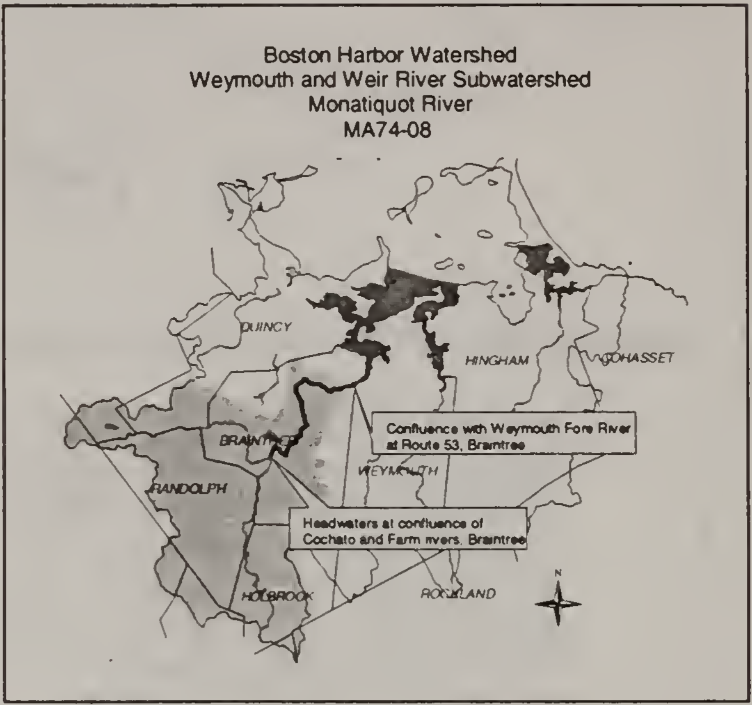
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS FARM RIVER (MA74-07)

- The Farm River is the headwaters for the Monatiquot River. A moderately impacted benthic community was identified in the Monatiquot River by DWM in 1999. The estimated 7Q10 from the USGS Streamflow Statistics for Massachusetts webpage (http://ma.water.usgs.gov/streamstats/) for the Monatiquot River at Gage 01105580 (Monatiquot River at South Braintree) is 0.5 cfs and the estimated 7Q10 at Gage 01105582 (Monatiquot River at East Braintree) is 0.22 cfs. Work with MA DEP Northeast Regional Office to determine the water withdrawal practices from the Farm River by the Braintree Water and Sewer Department and to develop WMA permit limits as necessary to maintain baseflows in the Farm River for the protection of Aquatic Life.

MONATIQUOT RIVER (SEGMENT MA74-08)

Location: Headwaters at confluence of Cochato and Farm rivers, Braintree to confluence with Weymouth Fore River at Route 53, Braintree.
Segment Area: 4.3 miles.
Classification: Class B


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Monatiquot River
MA74-08
QUINCY
HINGHAM
COHASSET
Confluence with Weymouth Fore River at Route 53, Braintree
BRAINTREE
WEYMOUTH
RANDOLPH
Headwaters at confluence of Cochato and Farm rivers, Braintree
HOLBROOK
ROCKLAND
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	37%
Forest	36%
Open Land	8%

The Monatiquot River is the main tributary to the Fore River Estuary. It is located about 10 miles south of Boston and encompasses 28.5 mi^2. The river lies within the towns of Braintree, Randolph, Holbrook, Avon, Stoughton, Milton, Canton, and Quincy (Franklin 2001). This segment is on the 1998 303(d) list of impaired waters needing confirmation for organic enrichment/ low DO and pathogens (MA DEP 1999a). The use assessment for Sunset Lake is provided in the Lakes section of this assessment report (Table 12).

In the Town of Braintree, sanitary sewage overflows (SSOs) have occurred at various locations throughout the Town including the Howard Street Pumping Station, the Allen Street Siphon, Trotters Green, the Beach Front area, Surrey Lane, Union Street, the Common Street Pump Station, Bestick Road, the Grove Street Pump Station, the Brookside Road Pump Station, and Prospect Street. These overflows have discharged to the Monatiquot River. There were more than 120 overflow events from 1993 to 1999. Additionally, under certain wet weather conditions, overflows from the existing MWRA regional sewer system have discharged into the Monatiquot River. Both the Town of Braintree and MWRA are currently working with DEP to reduce the frequency, duration, and volume of overflows including the construction of the Braintree-Weymouth Relief Facilities by MWRA and the implementation of infiltration reduction projects by Braintree. Both the Towns of Weymouth and Braintree and MWRA are currently working with DEP to reduce the frequency, duration, and volume of SSO events (Chretien 2002).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment.

However, for three weeks during the months of June, July, August, and September, up to 80% of the flow of the Farm River (the headwaters of this segment) may be diverted to Richardi Reservoir where it is then pumped to Great Pond for use by the Braintree Water and Sewer Department for the municipal supply of Braintree, Randolph and Holbrook. The amount of water pumped from Richardi Reservoir to Great Pond Reservoir varies year to year. 310 million gallons were pumped from Richardi to Great Pond in 2000, representing approximately 10% of the water withdrawn (Jean 2002).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted a benthic macroinvertebrate survey at one station on the Monatiquot River (MR01) downstream from Middle Street, Braintree. The benthic community was only 47% comparable (moderately impacted) to the reference station at Hawes Brook (Appendix C).

In April 1997, a field sampling program was conducted for the Fore River Watershed Association to determine the existence of a herring population along the Monatiquot River (Franklin 2001). River herring were found within the Monatiquot River, however, sightings were limited. The spillway at McCusker Drive was identified as a possible barrier to migration. In addition to fish counts limited chlorophyll *a*, ammonia, nitrate, and phosphate samples were collected.

Habitat/Flow

As part of the 1999 benthic survey, DEP DWM conducted a habitat assessment (Appendix C). The sampling reach was almost completely channelized, with "rip-rap" placed along both banks. Occasional areas of erosion and sloughing were observed with silty deposits possibly originating from the upstream road crossings and adjacent roadways.

As part of the Massachusetts Watershed Initiative MWI99-02 grant project, flow data was collected by USGS from the Monatiquot River at Commercial Street in East Braintree (Gage 01105583) on ten occasions between June 1999 and June 2000. Discharges in 1999 ranged from 0.55 to 42 cfs and in 2000 ranged from 31 to 130 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001). The estimated 7Q10 from the USGS Streamflow Statistics for Massachusetts webpage (http://ma.water.usgs.gov/streamstats/) for the Monatiquot River at Gage 01105580 (Monatiquot River at South Braintree) is 0.5 cfs and the estimated 7Q10 at Gage 01105582 (Monatiquot River at East Braintree) is 0.22 cfs. Both sites are upstream of Gage 01105583. It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

Chemistry – water

As part of the Massachusetts Watershed Initiative Grant MWI99-02, USGS also collected DO, temperature, ammonia-nitrogen, and phosphorus samples at Commercial Street in East Braintree between June 1999 and June 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001).

DO

Dissolved oxygen concentrations ranged between 7.7 and 11.8 mg/L (n=11). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature measurements (n=11) were below the SWQS for a Class B waterbody.

pH

pH ranged from 6.4 to 7.5 SU (n=11) with only one sample below 6.5 SU.

Ammonia-Nitrogen (as N)

Ammonia-Nitrogen concentrations ranged from BDL to 0.315 mg/L. All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between BDL and 0.042 mg/L (n=11).

Based on the moderately impacted benthic community (loss of Ephemeroptera, Plecoptera, Trichoptera taxa and scrapers, as well as hyperdominance of one taxon), the channelized streambed, and landuse information, the *Aquatic Life Use* for the Monatiquot River is assessed as non-support.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

The Fore River Watershed Association has been collecting fecal coliform bacteria samples from the Monatiquot River at Shaw Street. Although the data did not meet DEP's quality assurance guidelines, bacteria counts were above 400 cfu/100mL in eight of the 18 samples (Franklin 2001). In April 1997, the Fore River Watershed Association identified an outfall pipe discharging to the Monatiquot River. Further investigation identified this pipe as a source of fecal coliform bacteria (Franklin 2001).

As part of the Massachusetts Watershed Initiative MWI99-02 grant project, USGS collected fecal coliform bacteria samples from the Monatiquot River (Commercial Street in East Braintree) in 1999 and 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001). Fecal coliform bacteria counts ranged from 270 to 4,800 cfu/100mL (n=10). Seven of the ten samples were collected during the primary contact recreation season with 71% greater than 400 cfu/100mL. Sampling events were indicative of wet and dry weather conditions.

It should be noted that SSOs are common in this subwatershed. The Town of Braintree has had more than 120 overflow events between 1993 and 1999, from multiple locations including Howard Street Pumping Station, Allen Street Siphon, Trotters Green, Beach Front area, Surrey Lane, Union Street, Common Street Pump Station, Bestick Road, Grove Street Pump Station, Brookside Road Pump Station, and Prospect Street. The Town of Braintree and MWRA are currently working with DEP to reduce the frequency, duration, and volume of SSO events (Chretien 2002).

Based on the frequency of elevated fecal coliform bacteria counts, during both wet and dry weather conditions, the *Primary* and *Secondary Contact Recreational use* is assessed as non-support.

AESTHETICS

During the 1999 DWM habitat survey some instream turbidity was noted. No other objectionable conditions were recorded (i.e. no odors, oily sheens, trash/debris).

Too little current information (i.e., spatial and temporal coverage) is available to assess this use; therefore, the *Aesthetics Use* for the Monatiquot River is currently not assessed.

Monatiquot River (MA74-08) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NON SUPPORT	Unknown, habitat alteration		Unknown, hydromodification	SSO, urban runoff/ storm sewers
Fish Consumption		NOT ASSESSED				
Primary Contact		NON SUPPORT	Pathogens		Unknown, urban runoff/storm sewers, municipal point source (SSO)	
Secondary Contact		NON SUPPORT	Pathogens		Unknown, urban runoff/storm sewers, municipal point source (SSO)	
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS MONATIQUOT RIVER (MA74-08)

- Work with the Fore River Watershed Association to develop a QAPP for their future water quality monitoring data. Continue to review the Fore River Watershed Association fish count and water quality data as it becomes available.

- Investigate sources of fecal coliform bacteria from the pipe identified by the Fore River Watershed Association.

- Continue to monitor pathogen levels in the Monatiquot River to determine the effectiveness of the MWRA and Town of Braintree sewer system improvements.

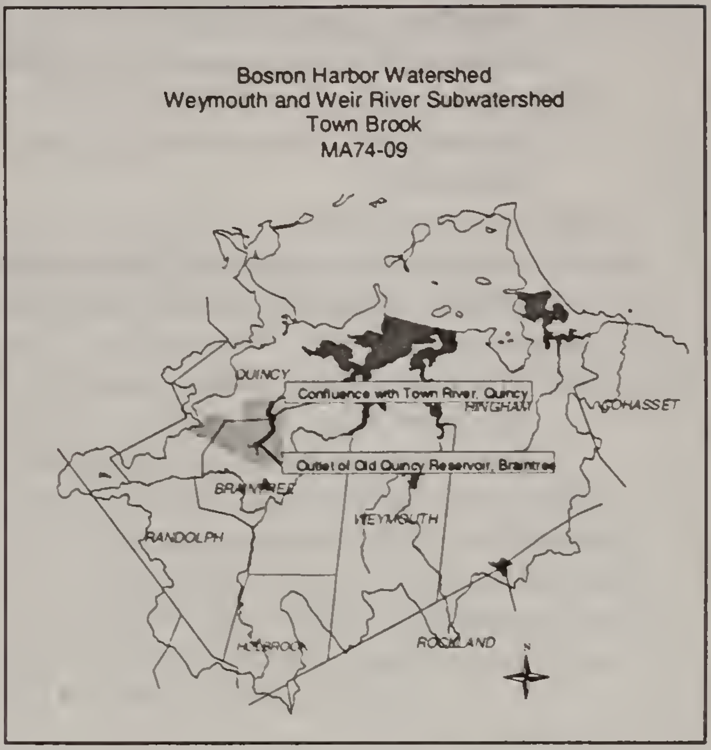
- Work with MA DEP Northeast Regional Office to determine the water withdrawal practices from the Farm River by the Braintree Water and Sewer Department and to develop WMA permit limits as necessary to maintain baseflows in the Farm River for the protection of Aquatic Life.

TOWN BROOK (SEGMENT MA74-09)

Location: Outlet Old Quincy Reservoir, Braintree to confluence with Town River, north of Route 3A, Quincy (includes the "Canal")
Segment Area: 3.5 miles.
Classification: Class B.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Residential	30%
Forest	22%
Industrial	14 %


Bosron Harbor Watershed
Weymouth and Weir River Subwatershed
Town Brook
MA74-09
QUINCY
Confluence with Town River, Quincy
HINGHAM
COHASSET
Outlet of Old Quincy Reservoir, Braintree
BRAINTREE
WEYMOUTH
RANDOLPH
HOLBROOK
ROCKLAND
N

The Old Quincy Reservoir Dam is located along this segment. It is maintained by Braintree Water/Sewer Department (Ryan 2001). Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm. Town Brook, an urban interrupted stream, is above ground for approximately 0.6 miles from the outlet of Old Quincy Reservoir downstream to the Route 3 interchange in Braintree. The brook then is mostly underground until Revere Road where it emerges and is then above for approximately 0.3 miles. The Army Corps of Engineers (ACOE) in corporation with the Commonwealth of Massachusetts is modifying the channel of Town River, constructing a flood relief tunnel under Quincy Center, and reconstructing the Old Quincy Dam in Braintree to control flooding in the Town Brook subwatershed (ACOE 30 April 2001). All phases of this flood control project will be turned over to the MDC.

WMA WATER WITHDRAWAL SUMMARY:

There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

Massachusetts Bay Transit Authority (MBTA) Quincy Pump Station (MA0033987) is permitted to discharge 0.216 MGD of wet weather flow and groundwater to Town Brook. The permit expires on 3 September 2002. The acute and chronic toxicity limits are 100% effluent. This facility is currently using lab water as dilution water in the whole effluent toxicity tests. The facility should at least run Town Brook water as a toxicity test control.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Between February 1998 and February 2001, MBTA Quincy Pump Station conducted 12 modified acute and chronic whole effluent toxicity tests using the inland silverside, *Menidia beryllina*. With the exception of one test (September 1998 LC_{50}=97.7% effluent), acute toxicity was not detected (LC_{50} $\geq$100% effluent). Chronic toxicity was detected in four test events, violating the permit limit of 100% effluent (range: <6.25 to 100%).

Habitat/Flow

Town Brook is underground and culverted for the majority of is 3.5-mile length. The ACOE has constructed a flood relief tunnel under Quincy Center (completed 1997-1998) and is reconstructing the Old Quincy Dam in Braintree to control flooding in the Town Brook subwatershed (ACOE 30 April 2001). The tunnel begins between Granite Street and Parking Way at the Star Market. The 12 foot deep, 4,000-foot long tunnel only receives inflow during major storm events. The tunnel is a deep rock tunnel with a drop-in at both ends. Additionally, a weir is located at the bottom end and aerators are placed in the tunnel to maintain sufficient DO levels. Between storms, storm water can enter the tunnel at high tide. The floodwater re-enters Town Brook between the South Artery and Washington Street. Prior to 2000, a sediment and brush blockage was causing water from Town Brook to backup into the tunnel thereby bypassing smelt spawning habitat. This condition has since been rectified by reconstruction of the MDC and City of Quincy owned portion of the flood control project (ACOE 2001).

Upstream of Town Brook, the Burgin Brook Diversion Tunnel was constructed to convey floodwaters away from Burgin Brook. The tunnel is similar to the Town Brook Diversion Tunnel. Flows from the Burgin Brook Tunnel are emptied into the Town Brook Tunnel and then into Town Brook. Prior to entering Town Brook Tunnel, sediments are captured in a sediment-settling basin (Galvin 2002).

Flow data was collected on Town Brook by USGS at their gage (01105585) downstream from Miller Stile Road, Quincy during ten occasions between May 1999 and June 2000 as part of the Massachusetts Watershed Initiative MWI99-02 grant project. Discharges ranged from 0.33 to 7.7 cfs with a seventeen-year average of 8.15 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001). It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001). The lowest daily mean discharge of 0.33 cfs was recorded on 3 October 1999.

Chemistry – water

Also as part of the Massachusetts Watershed Initiative Grant MWI99-02, USGS sampled dissolved oxygen, temperature, ammonia-nitrogen, and phosphorus at their gage (01105585) downstream from Miller Stile Road, Quincy between May 1999 and June 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001). In conjunction with the Town Brook flood control project the ACOE collected grab samples (DO, pH, temperature, nitrogen, phosphorus, and TSS) upstream from the tunnel outlet and compared them to the tunnel water. These data indicated similar results in both the brook and tunnel water (ACOE 2001).

DO

Dissolved oxygen concentrations ranged between 7.2 and 11.7 mg/L (n=10). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody (n=10).

pH

pH ranged from 6.2 to 7.4 SU with only one less than 6.5 SU (n=10).

Ammonia-Nitrogen (as N)

Ammonia-Nitrogen concentrations ranged from 0.050 to 0.333 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus concentrations ranged between 0.004 (estimated) and 0.073 mg/L (n=10).

Based on the loss of habitat due to the underground and channelized nature of this brook and best professional judgment, the *Aquatic Life Use* is assessed as non-support.

PRIMARY AND SECONDARY CONTACT RECREATION

As part of the MWI99-02 grant project, USGS collected fecal coliform bacteria samples from their gage (01105585) downstream from Miller Stile Road, Quincy on ten occasions between May 1998 and June 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts ranged from 420 to 23,000 cfu/100mL. Levels were above 2,000 cfu/100mL in half the samples and were above 4,000 in one sample.

Based on the frequency of elevated fecal coliform bacteria counts, during both wet and dry weather conditions, the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

Town Brook (MA74-09) Use Summary Table

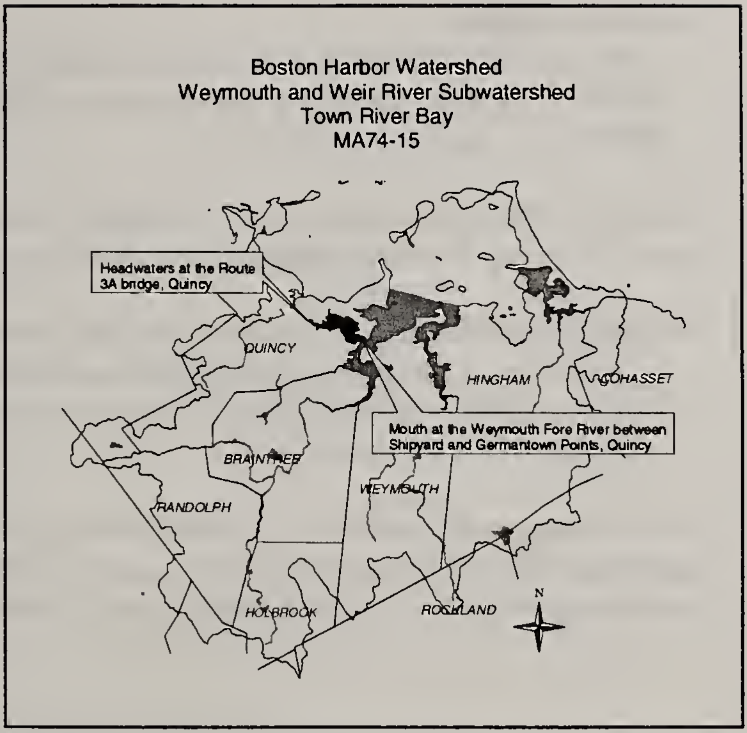
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NON SUPPORT	Habitat alteration, unknown		Hydromodification, Unknown	
Fish Consumption		NOT ASSESSED				
Primary Contact		NON SUPPORT	Pathogens		Unknown	Urban runoff/ storm sewers
Secondary Contact		NON SUPPORT	Pathogens		Unknown	Urban runoff/ storm sewers
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS TOWN BROOK (MA74-09)

- The Massachusetts Bay Transit Authority (MBTA) Quincy Pump Station (MA0033987) should collect water from Town Brook upstream of their discharge to use as dilution water in their whole effluent toxicity tests. If the brook water does not meet the control test acceptability criteria (e.g., survival > 80% at 7-day), then Town Brook water must still be utilized as a test control and not as diluent.
- Work with Braintree and Quincy to identify failing septic systems and illicit sewer connections that may be contributing bacteria to Town Brook.

TOWN RIVER BAY (SEGMENT MA74-15)

Location: From the headwaters at the Route 3A bridge in Quincy, to its mouth at the Weymouth Fore River between Shipyard and Germantown Points, Quincy.
Segment Area: 0.5 square miles.
Classification: Class SA.


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Town River Bay
MA74-15
Headwaters at the Route 3A bridge, Quincy
QUINCY
HINGHAM
COHASSET
Mouth at the Weymouth Fore River between Shipyard and Germantown Points, Quincy
BRAINTREE
WEYMOUTH
RANDOLPH
HOLBROOK
ROCKLAND
N

LandOuse estimates for this subwatershed are unavailable.

This segment is on the 1998 303(d) list of impaired waters for organic enrichment/ low DO and pathogens (MA DEP 1999a).

WMA WATER WITHDRAWAL SUMMARY:
There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:
Twin Rivers Technologies, L.P. (MA0004073) is permitted to discharge via two outfalls: 001 (to the Weymouth Fore River) and 003. The facility is permitted to discharge 10 MGD of non-contact cooling water and boiler blow down water via 003 to this segment. The permit includes an 87°F temperature limit. The facilities permit states that if their acute toxicity test is < 100% effluent they must retest within 30 days. The permit expires on 26 March 2002. This discharge is tidally influenced.

Sprague Electric (MA0020869) is permitted to discharge treated storm water runoff from the diked and not diked areas via outfall 001. The permit includes monitoring requirements for flow, pH, and PAHs and limits for TSS (100 mg/L maximum daily) and oil/grease (15 mg/L). The permit expires on 4 June 2003.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

Additionally, there are two vessel sewage pump-out facilities located on Town River Bay: Bay Pointe Marina and Town River Yacht Club (CZM 3 October 2001).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Between 1997 and 2000, Twin Rivers Technologies, L.P. (MA0004073) conducted annual whole effluent toxicity tests on outfall 003 using the mysid shrimp *M. bahia*. Of the four test events the LC_{50} was less than 100% effluent on two occasions (80 and 77% effluent). The facilities permit requires a retest within 30 days if an LC_{50} is less than 100% effluent.

Ambient

Between 1997 and 2000, Twin Rivers Technologies, L.P. (MA0004073) used water from Town River Bay as dilution water in their annual whole effluent toxicity tests. Survival of the mysid shrimp *M. bahia* exposed (48-hour) to the Bay water was good (>90%).

Scant instream water quality data were available to assess the *Aquatic Life Use*; it is therefore not assessed.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.23 and GB1H.31 are conditionally restricted and GBH1.0, GBH1.22 and GBH1.24 are prohibited (DFWELE 2000).

Based on this information the *Shellfishing Use* is assessed as partial support for 0.13 mi^2 and non-support for 0.37 mi^2 of this segment of Town River Bay.

PRIMARY AND SECONDARY CONTACT RECREATION

In 1999, one bathing beach advisory was issued for Rhoda Beach. The City of Quincy Health Department identified breaks in pipes, boat discharges, and/or storm water as the possible sources of pollution (EPA 20 July 2000).

The *Primary* and *Secondary Contact Recreational* uses are not assessed due to the lack of available bacteria data. This segment is however, on "Alert Status" due to the probability of elevated bacteria counts as indicated by the bathing beach closure.

Town River Bay (MA74-15) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Shellfishing	PARTIAL SUPPORT 0.13 mi^2 NON-SUPPORT 0.37 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact*	NOT ASSESSED*				
Secondary Contact*	NOT ASSESSED*				
Aesthetics	NOT ASSESSED				

* "Alert Status" Issues Identified- See *Primary* and *Secondary Contact Recreational* uses

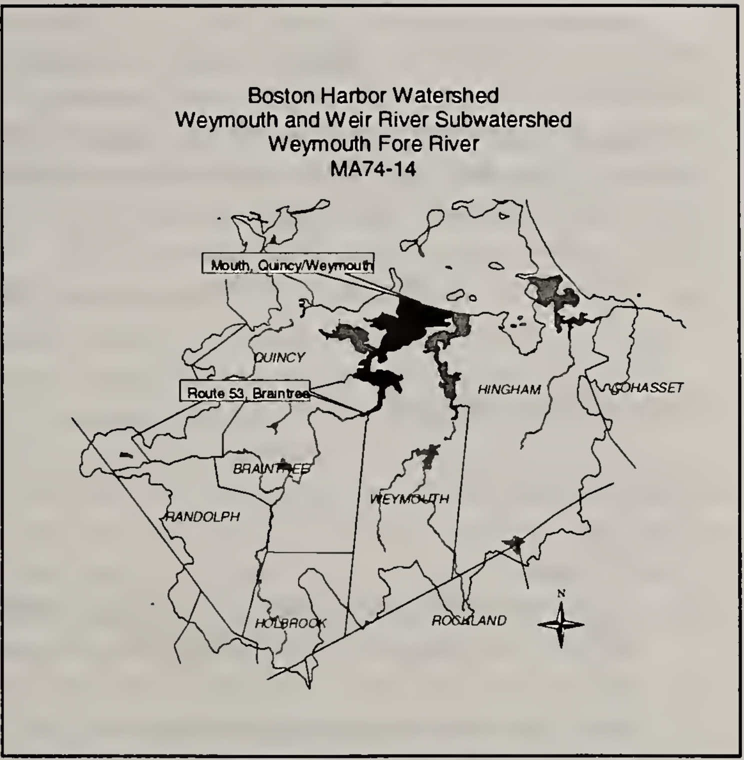
RECOMMENDATIONS TOWN RIVER BAY (MA74-15)

- If the Twin Rivers LC_{50} <100%, the facility needs to retest again within thirty days as stated in their NPDES permit. If toxicity test results continue to violate permit limits (frequency and severity of violations considered), a toxicity identification and reduction evaluation should be conducted.

WEYMOUTH FORE RIVER (SEGMENT MA74-14)

Location: Route 53, Braintree to mouth (eastern point at Lower Neck, Weymouth and western point at Wall Street on Houghs Neck, Quincy).
Segment Area: 3.3 square miles.
Classification: Class SB, Shellfishing (Restricted).

Land use estimates for this subwatershed are unavailable.



This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). In the Town of Weymouth, sanitary sewer overflows have occurred to Whitman's Pond, Mill River, Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. In the Town of Braintree, sanitary sewage overflows have occurred at various locations throughout the Town including the Howard Street Pumping Station, the Allen Street Siphon, Trotters Green, the Beach Front area, Surrey Lane, Union Street, the Common Street Pump Station, Bestick Road, the Grove Street Pump Station, the Brookside Road Pump Station, and Prospect Street. These overflows have discharged to the Monatiquot River. There were more than 120 overflow events from 1993 to 1999. Additionally, under certain wet weather conditions, overflows from the existing MWRA regional sewer system have discharged into the Weymouth Fore River and Smelt Brook. The MWRA Smelt Brook Siphon has been the most significant location of overflows. Since 1996, is has overflowed several times each year for periods of up to 11 days on certain occasions. Both the Towns of Weymouth and Braintree and MWRA are currently working with DEP to reduce the frequency, duration, and volume of SSO events (Chretien, 2002).

In 1988 and 1989 DMF conducted anadromous rainbow smelt spawning surveys in the Weymouth Fore River. According to Chase (1990) the Fore River is one of the "top smelt producing rivers in Massachusetts Bay".

WMA WATER WITHDRAWAL SUMMARY:

There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

Twin Rivers Technologies, L.P. (MA0004073) is permitted to discharge via two outfalls: 001 and 003 (to Town River Bay). The facility is permitted to discharge 1 MGD of non-contact cooling water and storm water via 001 to this segment. The permit includes an 87°F temperature limit. The facilities permit states that if their acute toxicity test is < 100% effluent they must retest within 30 days. The permit expires on 26 March 2002. This discharge is tidally influenced.

The proposed Fore River Station is a nominal 750-775 megawatt (MW) natural gas fired combined cycle power plant to be developed and operated by Sithe Edgar Development, LLC (Sithe), an affiliate of Sithe Energies Group. The Fore River Station will be located at the site of the retired Boston Edison Company Edgar Station in Weymouth, Massachusetts. The former Edgar site, together with Boston Edison Company generating facilities in Everett, South Boston, Framingham and Medway, was acquired by Sithe in a transaction completed on 15 May 1998 (MA DEP 22 Feb 2000). It should be noted that this facility will only have storm water discharges and there will be no operational discharges to the river.

The MWRA is presently digging a deep rock tunnel under the Fore River from North Weymouth to the Nut Island Inter Island Tunnel. The tunnel under the Fore River is a major component of the $175 million MWRA Braintree-Weymouth Relief Facilities construction project that will increase existing sewer service capacity from 55 MGD to 73 MGD for the communities of Braintree, Weymouth, Holbrook, Randolph, and Hingham. Wastewaters from the construction site run-off and tunnel dewatering discharge to the Fore River after receiving treatment by chemical addition, clarification, and filtration. NPDES General Permit No. MAG070047 covers discharges up to 5000 gpm from these treatment facilities. Presently, however, the system only discharges up to about 2000 gpm (Chretien 2002).

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Between 1998 and 2000, Twin Rivers Technologies, L.P. (MA0004073) conducted annual whole effluent toxicity tests on Outfall 001 using the mysid shrimp *M. bahia*. The LC_{50} was less than 100% effluent on only one occasion (74% effluent). The facilities permit requires a retest within 30 days if an LC_{50} is less than 100% effluent.

Ambient

Between 1998 and 2000, Twin Rivers Technologies, L.P. (MA0004073) uses water from Town River Bay as dilution water in their annual whole effluent toxicity tests. Survival of *M. bahia* exposed (48-hour) to the Bay water was good (100%).

Chemistry - water

As part of their ongoing receiving water monitoring program, MWRA collected monthly surface and bottom water quality samples (DO and temperature) between 1996 and 2000 at station 116, Hingham Bay, mouth of Fore River, red Nun #28 (Coughlin 2001a and 2002).

DO

Dissolved oxygen concentrations were not below 5.0mg/L in the surface or bottom waters during any of the sampling events (n=135). Dissolved oxygen concentrations ranged from 5.35 to 13.13 mg/L and percent saturation ranged from 71.7 to 125.8% with only three greater than 115%. No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

No temperature readings (n=144) were above the SWQS for a class SB waterbody.

Turbidity

Turbidity levels ranged from 0 to 37 NTU and an average of 7.33 NTU (n=89).

Chlorophyll a

Chlorophyll *a* measurements (n=85) ranged from 4.33 to 28.30 µg/L in the surface and bottom waters.

Suspended Solids

TSS measurements (n=79) ranged from 0.9 to 41.4 mg/L with only two greater than 25 mg/L collected during dry weather conditions.

The *Aquatic Life Use* is assessed as support for the Weymouth Fore River based on multiple years of water chemistry data (DO, temperature, water clarity and chlorophyll *a*) with limited exceedances of the SWQS for a Class SB waterbody.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.10, GBH 1.13, GBH1.20, GBH1.25 and GBH1.26 are conditionally restricted and GBH1.27 is management closure, and GBH1.0, GBH1.20, and GBH1.21 are prohibited (DFWELE 2000).

Based on this information the *Shellfishing Use* is assessed as partial support for 0.63 mi^2, non-support for 2.56 mi^2 while the remaining 0.11 mi^2 of this segment of the Weymouth Fore River are not assessed due to the management closure.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

The MWRA also collected fecal coliform bacteria samples at site 116 Hingham Bay, mouth of Fore River, red Nun #28 as part of their ongoing receiving water monitoring program (Coughlin 2002) between 1996 and 2000. Fecal coliform bacteria counts ranged between <5 and 8,400 cfu/100mL (n=116). Samples were collected during both wet and dry weather conditions. During the primary contact season, fecal coliform bacteria counts ranged between <5 and 2,560 cfu/100mL with only five of the 69 counts greater than 400 cfu/100mL. Additionally, MWRA recorded Secchi disk depths at this station on 169 occasions (range: 1.0 – 6 m) with only three readings below 1.2 m. It should be noted that SSOs are common in this subwatershed. The MWRA Smelt Brook Siphon has overflowed several times each year since 1996, and at times for up to 11 days per event (Chretien 2002).

While fecal coliform bacteria counts were low during both wet and dry weather conditions at MWRA's monitoring station, the *Primary* and *Secondary Contact Recreational* uses are assessed as partial support due to the frequency of SSO events and the probability of elevated bacteria counts associated with them.

Weymouth Fore River (MA74-14) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.63 mi^2 NON- SUPPORT 2.56 mi^2 NOT ASSESSED 0.11 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		PARTIAL SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Secondary Contact		PARTIAL SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS WEYMOUTH FORE RIVER (MA74-14)

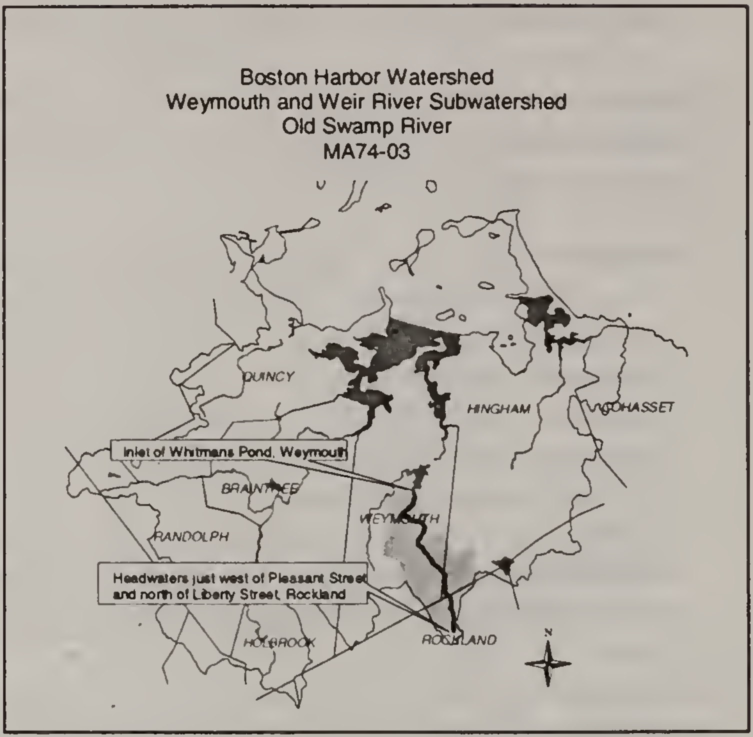
- If the Twin Rivers LC$_{50}$ <100%, the facility needs to retest again within thirty days as stated in their NPDES permit. If toxicity test results continue to violate permit limits (frequency and severity of violations considered), a toxicity identification and reduction evaluation should be conducted.
- Continue to monitor fecal coliform bacteria counts in the Weymouth Fore River to determine if the Braintree, Weymouth, and MWRA sewer projects aimed at reducing the number of sanitary sewer overflows to this subwatershed are effective.

OLD SWAMP RIVER (SEGMENT MA74-03)

Location: Headwaters just west of Pleasant Street and north of Liberty Street, Rockland to inlet Whitmans Pond, Weymouth.
Segment Area: 4.4 miles.
Classification: Class A.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	41%
Residential	34%
Open Land	7%
Industrial	7%


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Old Swamp River
MA74-03
QUINCY
HINGHAM
COHASSET
Inlet of Whitmans Pond, Weymouth
BRAINTREE
WEYMOUTH
RANDOLPH
Headwaters just west of Pleasant Street and north of Liberty Street, Rockland
HOLBROOK
ROCKLAND
N

This segment is on the 1998 303(d) list of impaired waters needing confirmation for pathogens (MA DEP 1999a). In 2001, DFWELE stocked trout in the Old Swamp River for the purpose of recreational fishing (DFWELE 15 March 2001). DFWELE has proposed that this segment be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

In the Town of Weymouth, sanitary sewer overflows have occurred to Whitman's Pond, Mill River, Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. The Town of Weymouth is currently working with DEP to reduce the frequency, duration, and volume of SSO events and has undertaken a capital improvement project and extensive infiltration and inflow removal work (Chretien, 2002).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Weymouth DPW- Water Division	3336000		31933601	03G	4.51*	4.43

* System-wide withdrawal

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999 DEP DWM conducted a benthic macroinvertebrate survey at station SR01 on Old Swamp River just upstream from the USGS gage (01105600) in Weymouth. The SR01 benthic community was 65% comparable to the reference station NE09, resulting in a "slightly impacted" bioassessment (Appendix C).

Habitat/Flow

A habitat assessment was conducted by DEP DWM as part of the July 1999 benthic survey. Habitat quality for the benthic community was good while fish habitat quality was suboptimal. Further investigations identified areas of massive riparian zone removal and erosion in the vicinity of a housing development located between Pleasant Street and Oak Street in Weymouth (Appendix C).

As part of the MWI99-02 grant project, flow data was collected at USGS gage (01105600) on Old Swamp River on ten occasions between May 1999 and June 2000. Discharges in 1999 ranged from 0.55 to 15 cfs and in 2000 ranged from 6.2 to 15 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001). The 34-year average streamflow at this gage is 9.17 cfs (Socolow *et al.* 2001). It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

Chemistry – water

Also, as part of this MWI Grant the USGS collected dissolved oxygen, temperature, ammonia-nitrogen, and phosphorus samples from their gage (01105600) on Old Swamp River on ten occasions between May 1999 and June 2000 (Socolow *et al.* 2000 and Socolow *et al.* 2001).

DO

Dissolved oxygen concentrations ranged between 7.2 and 11.7 mg/L (n=10). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature measurements were below the SWQS for a Class B waterbody.

pH

pH ranged from 6.4 to 7.3 SU with only one measurement below 6.5 SU (n=10).

Ammonia-Nitrogen (as N)

Ammonia-Nitrogen concentrations ranged from BDL to 0.071 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus

Total phosphorus concentrations (n=10) ranged between 0.004 (estimated) and 0.080 mg/L with an average of 0.029 mg/L.

Due to insufficient data/information, the upper 2.4 miles are currently not assessed. Based on a slightly impaired benthic community (i.e., pollution tolerant species) the *Aquatic Life Use* is assessed as partial support downstream from Mt. Hope Cemetery (lower 2.0 miles).

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of the MWI grant project, USGS also collected fecal coliform bacteria samples from Old Swamp River on eight occasions at their gage (Socolow *et al.* 2000 and Socolow *et al.* 2001). Bacteria concentrations ranged from 10 to 2,400 cfu/100mL (n=9) with counts above 400 cfu/100mL on one occasion. However, between 1992 and March 1999, 530 sanitary sewer overflow events occurred in the Town of Weymouth. The Town is working to reduce the number of SSO events and is conducting I/I work (Chretien 2002).

The *Primary* and *Secondary Contact Recreational* uses are assessed as partial support due to SSO events and historically high bacteria counts.

AESTHETICS

No obvious signs of aesthetic quality degradation were noted, however, upstream of the sampling reach DWM identified areas of massive riparian zone removal and erosion in the vicinity of a housing development located between Pleasant Street and Oak Street in Weymouth (Appendix C).

Based on the overall high aesthetic quality and land use information Old Swamp Brook is assessed as support for the *Aesthetics Use*. This brook is however on “Alert Status” due to the encroaching housing development (riparian disruption and resulting erosion).

Old Swamp River (MA74-03) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED upper 2.4 miles PARTIAL SUPPORT lower 2.0 miles	Unknown		Unknown	SSO
Fish Consumption		NOT ASSESSED				
Primary Contact		PARTIAL SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Secondary Contact		PARTIAL SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Aesthetics*		SUPPORT*				

* "Alert Status" issues identified see *Aesthetics Use*

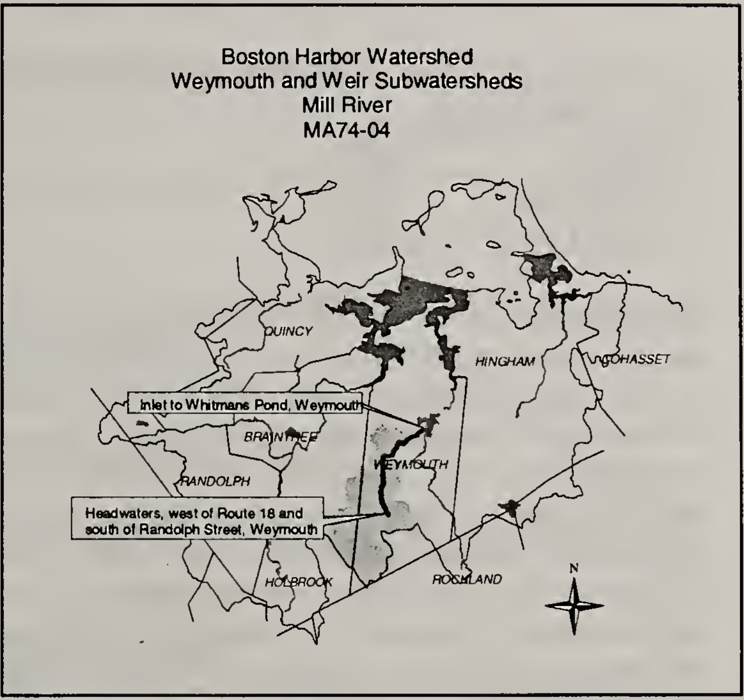
RECOMMENDATIONS OLD SWAMP RIVER (MA74-03)

- Through outreach awareness programs educate local residents on the importance of maintaining an adequate riparian zone. Investigate the need to implement BMPs to stabilize the streambanks and prevent further erosion.

- Conduct fecal coliform bacteria monitoring to determine the effects of SSO events on the Old Swamp River and to determine if sewer projects undertaken by the Town of Weymouth are effective in reducing bacteria inputs to the river

MILL RIVER (SEGMENT MA74-04)

Location: Headwaters, west of Route 18 and south of Randolph Street, Weymouth to inlet Whitmans Pond, Weymouth.
Segment Area: 3.5 miles.
Classification: Class A.


Boston Harbor Watershed
Weymouth and Weir Subwatersheds
Mill River
MA74-04
QUINCY
HINGHAM
COHASSET
Inlet to Whitmans Pond, Weymouth
BRAINTREE
RANDOLPH
WEYMOUTH
Headwaters, west of Route 18 and south of Randolph Street, Weymouth
HOLBROOK
ROCKLAND
N

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	44%
Residential	32%
Open Land	6%
Commercial	6%

This segment is on the 1998 303(d) list of impaired waters needing confirmation for nutrients, pathogens, and noxious aquatic plants (MA DEP 1999a). In the Town of Weymouth, sanitary sewer overflows have occurred to Whitman's Pond, Mill River, Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. The Town of Weymouth is currently working with DEP to reduce the frequency, duration, and volume of SSO events and has undertaken a capital improvement project and extensive infiltration and inflow removal work (Chretien, 2002).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Weymouth DPW- Water Division	3336000		31933601	01G 02G 04G 05G	4.51*	4.43

* System-wide withdrawal

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

Mill River (MA74-04) Use Summary Table

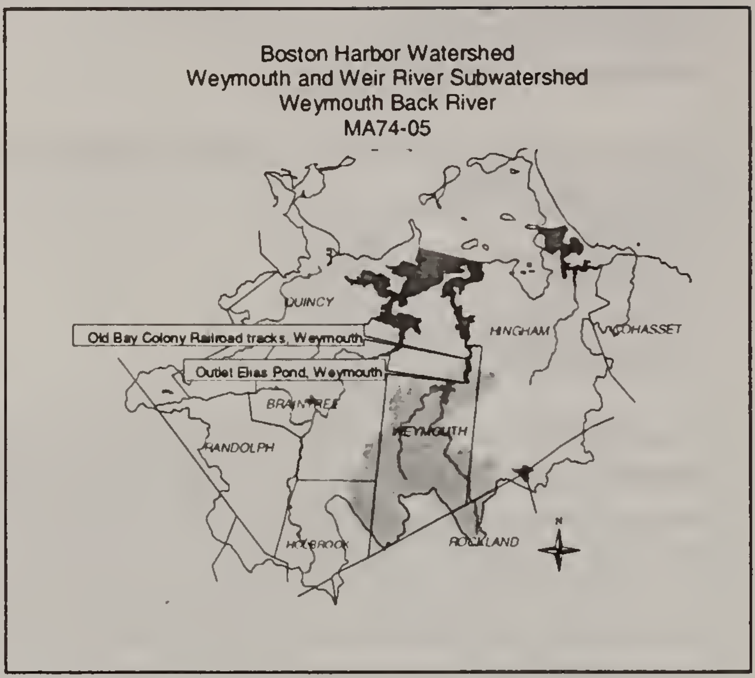
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

RECOMMENDATIONS MILL RIVER (MA74-04)

- Review stream flow data collected as part of the Weymouth DPW Water Division WMA permit to determine if water withdrawal practices are adversely impacting baseflows and fisheries on Mill River

WEYMOUTH BACK RIVER (SEGMENT MA74-05)

Location: Outlet Elias Pond to the old Bay Colony Railroad tracks, Weymouth.
Segment Area: 0.8 miles.
Classification: Class B, Warm Water Fishery, ORW



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	39%
Residential	36%
Open Land	7%

This segment is on the 1998 303(d) list of impaired waters needing confirmation for organic enrichment/ low DO and pathogens (MA DEP 1999a). In the Town of Weymouth, sanitary sewer overflows have occurred to Whitman's Pond, Mill River, Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. The Town of Weymouth is currently working with DEP to reduce the frequency, duration, and volume of SSO events and has undertaken a capital improvement project and extensive infiltration and inflow removal work (Chretien, 2002).

This segment is located within the 950-acre Weymouth Back River ACEC. Approximately 180 acres of which are tidal waters flushing into Hingham Bay and serve as shellfish areas and nursery grounds for finfish. Alewives and smelt return to the ACEC to spawn (MA DEM August 2000).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

The Town of Weymouth received State Revolving Fund money to develop a Stormwater Management Plan to support the Town's compliance with Phase II requirements (Chretien 2002).

USE ASSESSMENT

AQUATIC LIFE

Habitat/Flow

As part of the MWI99-02 grant project, USGS collected flow measurements downstream from Broad Street, East Weymouth between May 1999 and June 2000. Discharges in 1999 ranged from 0.53 to 11 cfs and in 2000 ranged from 12 to 19 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001). It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

Chemistry – water

As part of the MWI99-02 Grant, USGS sampled Weymouth Back River on ten occasions between May 1999 and June 2000 at their gage (01105612) downstream from Broad Street, East Weymouth. Parameters measured included dissolved oxygen, pH, temperature, ammonia-nitrogen, and total phosphorus (Socolow *et al.* 2000 and Socolow *et al.* 2001).

DO
USGS dissolved oxygen concentrations ranged between 6.7 and 11.8 mg/L (n=10). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature
All temperature readings were below the SWQS for a class SA waterbody.

pH
pH ranged from 6.3 to 7.6 SU (n=10) with only one less than 6.5 SU.

Ammonia-Nitrogen (as N)
Ammonia-Nitrogen concentrations ranged from BDL to 0.122 mg/L. All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)
Total phosphorus levels ranged between 0.005 (estimated) and 0.047 mg/L.

Based on the available chemical data (i.e., DO, pH, and temperature,) the *Aquatic Life Use* is assessed as support for this segment of the Weymouth Back River.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of the MWI99-02 grant project, USGS collected fecal coliform bacteria samples at their gage (01105612) downstream from Broad Street, East Weymouth. Fecal coliform levels (n=10) ranged from 40 to 28,000 cfu/100mL (dry weather). Bacteria counts were above 400 cfu/100mL in seven samples, above 2,000 cfu/100mL in four samples, and above 4,000 cfu/100mL in three samples. Samples were collected during both wet and dry weather conditions.

In the Town of Weymouth, sanitary sewer overflows have occurred to Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. The Town of Weymouth is currently working with DEP to reduce the frequency, duration, and volume of SSO events and has undertaken a capital improvement project and extensive infiltration and inflow removal work (Chretien, 2002).

Based on elevated bacteria counts during wet wand dry weather and the frequency of SSO events, the *Primary* and *Secondary Contact Recreational uses* are assessed as non-support for this segment of the Weymouth Back River.

Weymouth Back River (MA74-05) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Primary Contact		NON SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Secondary Contact		NON SUPPORT	Pathogens		Municipal point source (SSO), urban runoff / storm sewers	
Aesthetics		NOT ASSESSED				

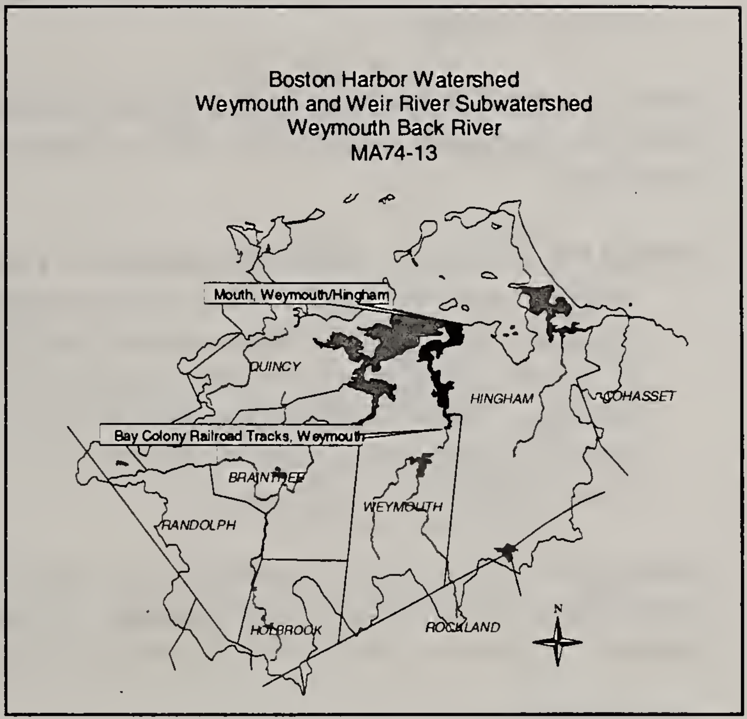
RECOMMENDATIONS WEYMOUTH BACK RIVER (MA74-05)

- Work with local groups to maintain the fish ladder at the headwaters of the Weymouth Back River.

- Continue to monitor fecal coliform bacteria counts to determine if sewer projects undertaken by the Town of Weymouth are effective in reducing bacteria inputs to the river

WEYMOUTH BACK RIVER (SEGMENT MA74-13)

Location: Old Bay Colony Railroad tracks, Weymouth to mouth between Lower Neck to the west and Wompatuck Road, Hingham.
Segment Area: 1.9 square miles.
Classification: Class SA, Shellfishing (Open)



This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). In the Town of Weymouth, sanitary sewer overflows have occurred to Whitman's Pond, Mill River, Back River, Fore River, and Old Swamp River. Between 1992 and March 1999, 530 overflow events were recorded. The Town of Weymouth is currently working with DEP to reduce the frequency, duration, and volume of SSO events and has undertaken a capital improvement project and extensive infiltration and inflow removal work (Chretien, 2002).

This segment is located within the 950-acre Weymouth Back River ACEC. Approximately 180 acres of which are tidal waters flushing into Hingham Bay and serve as shellfish areas and nursery grounds for finfish. Alewives and smelt return to the ACEC to spawn (MA DEM August 2000).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:
There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

As part of their ongoing receiving water monitoring program, MWRA collected water quality samples (dissolved oxygen, % saturation, temperature, and turbidity) from one station (086-Weymouth Back River, downstream from the Rte 3A bridge) between 1996 and 2000 (Coughlin 2002).

DO

MWRA DO concentrations ranged between 5.1 and 13.05 mg/L (n=125). Percent saturations ranged between 69.6 and 121% with only three greater than 115% (n=125). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings were below the SWQS for a class SA waterbody.

Turbidity

MWRA turbidity readings ranged from 0 to 10 NTU (n=101).

Based on the available chemical data (i.e., DO, temperature, and turbidity) the *Aquatic Life Use* is assessed as support for this segment of the Weymouth Back River.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.11, GBH1.13, GBH1.14 and GBH1.29 are conditionally restricted and GBH1.0, and GBH1.15 are prohibited (DFWELE 2000b).

Based on the conditionally restricted and prohibited status of the growing areas, the *Shellfishing Use* is assessed as partial support for 0.83 mi^2 and non-support for 1.07 mi^2 of this segment of the Weymouth Back River.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

MWRA collected fecal coliform bacteria samples as part of their ongoing receiving water monitoring at one station (086- downstream from Rte 3A bridge) on this segment of the Weymouth Back River (Coughlin 2002). Samples were collected during both wet and dry weather conditions. Fecal coliform bacteria counts (n=113) ranged from <5 to 1630 cfu/100mL (wet weather). During the primary contact season (n=66) fecal coliform bacteria counts ranged from <5 to 635 cfu/100 mL with only one count greater than 400 cfu/100mL.

Based on the low fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational uses* are assessed as support. This segment is, however, on "Alert Status" based on the possibility of elevated bacteria counts as a result of SSO events in this subwatershed.

AESTHETICS

MWRA collected Secchi disk transparencies at their water quality monitoring station on this segment of the Weymouth Back River between 1996 and 2000 (Coughlin 2002). Secchi disk depth ranged from 0.24 to 6 m with only 19 of the 161 readings not meeting the SWQS of 1.2 m.

Based on the good water clarity and land use information this segment of the Weymouth Back River is assessed as support for the *Aesthetics Use*

Weymouth Back River (MA74-13) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.83 mi^2 NON-SUPPORT 1.07 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact*		SUPPORT*				
Secondary Contact*		SUPPORT*				
Aesthetics		SUPPORT				

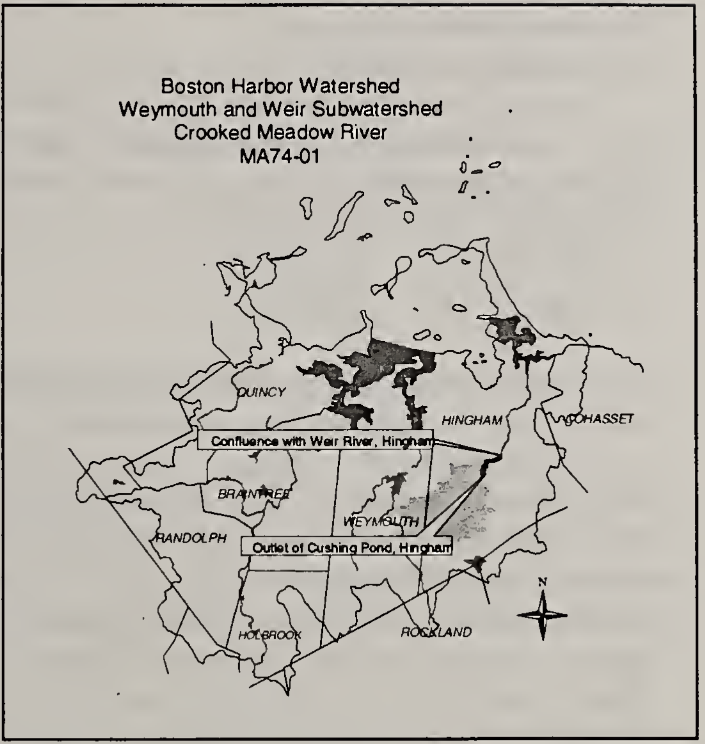
* "Alert Status" issues identified- See *Primary* and *Secondary Contact Recreational Use* assessments

RECOMMENDATIONS WEYMOUTH BACK RIVER (MA74-13)

- Continue to monitor fecal coliform bacteria counts to determine if sewer projects undertaken by the Town of Weymouth are effective in reducing bacteria inputs to the river.

CROOKED MEADOW RIVER (SEGMENT MA74-01)

Location: Outlet Cushing Pond, Hingham to confluence with Weir River, Hingham.
Segment Area: 0.9 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	45%
Residential	33%
Industrial	10%

Crooked Meadow River begins at the Cushing Pond dam. The Cushing Pond Dam (privately owned) is at the outlet of Cushing Pond and the headwaters of Crooked Meadow River (Ryan 2001). Additional information on dams in Massachusetts may be obtained from MA DEM at http://www.state.ma.us/dem/ and a MassGIS datalayer showing the location of dams in Massachusetts will soon be available at: http://www.state.ma.us/dem/programs/gis/de%5Fdl.htm. This segment is on the 1998 303(d) list of impaired waters needing confirmation for nutrients, organic enrichment/ low DO, and noxious aquatic plants (MA DEP 1999a).

WMA WATER WITHDRAWAL SUMMARY:

There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated wastewater discharges to this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

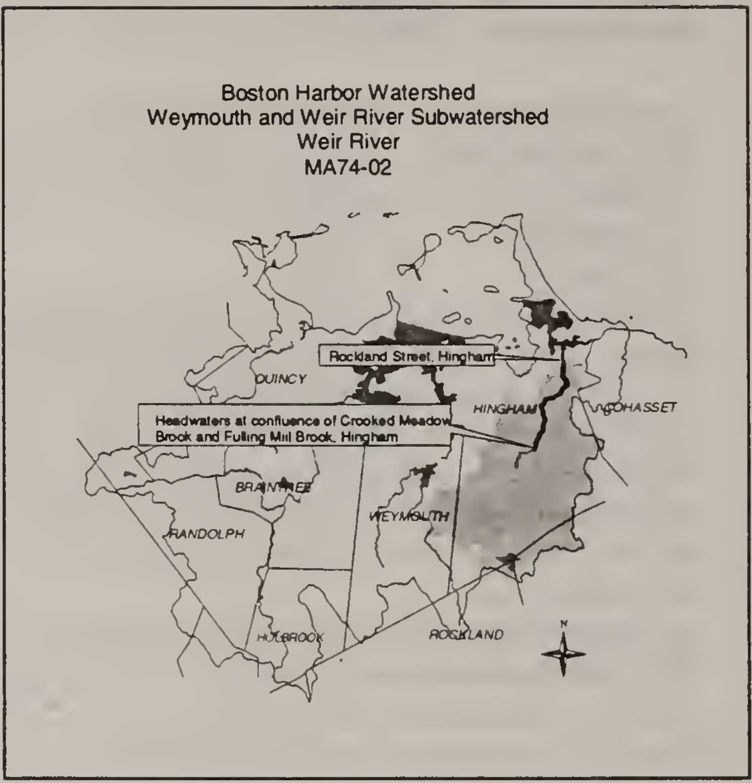
USE ASSESSMENT

Crooked Meadow River (MA74-01) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
Not Assessed				

WEIR RIVER (SEGMENT MA74-02)

Location: Headwaters at confluence of Crooked Meadow River and Fulling Mill Brook, Hingham to Rockland Street, Hingham.
Segment Area: 2.8 miles.
Classification: Class B.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	50%
Residential	32%
Open Land	6%

This segment is on the 1998 303(d) list of impaired waters needing confirmation for nutrients and pathogens (MA DEP 1999a). This segment flows through an impounded reach formed by Foundry Pond Dam, which is maintained by the Town of Hingham. The use assessment for Accord and Foundry ponds are provided in the Lakes section of this assessment report (Table 12). This segment is located within the Weir River ACEC (MA DEM August 2000). Although the data did not meet DEP's water quality assurance guidance, the Weir River Watershed Association collected staff gage readings at four stations along this segment between October 1999 and October 2000: WR1, (Foundry Pond Dam), WR2 (Route 3A), WR4 (Union St.), and WR5 (Free St.). Additionally they collected measurements at one tributary station WR3 (Triphammer Pond) (Woods, 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX G, TABLE G1):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source G = ground S=surface	Authorized Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Norwell Water Department	4219000	9P41921901	41921901	02G 03G 05G 11G	0.4 (permitted) 0.32 (registered)	Not available
Mass American Water Company - Hingham	3131000		31913101	1-6G 8G 2S 3S	3.51*	3.44

* System-wide withdrawal

Both the Norwell Water Department and Mass American Water Company – Hingham withdraw water from the Weir River subwatershed.

SURFACE NPDES DISCHARGE SUMMARY:

Merriman Inc., (MA0001821) was permitted to discharge to this segment. The Merriman site is currently listed as a MA DEP 21e hazardous waste site.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

During July 1999, DEP DWM conducted a benthic macroinvertebrate survey upstream from Route 228, Hingham at station WR01. The benthos assemblage was 82% comparable to the reference station NE09 resulting in a "non- to slightly-impacted" community (Appendix C). The benthic macroinvertebrate community had representatives of numerous feeding groups indicating balanced trophic structure and multiple food sources. Additionally, a fairly pollution intolerant species was dominant.

Habitat/Flow

Considerable instream sediment deposition compromised fish and macroinvertebrate habitat, but overall substrate embeddedness was low (Appendix C).

As part of the MWI99-02 grant project, USGS collected discharge measurements at the Route 3A bridge, Hingham between June 1999 and June 2000. Discharges in 1999 ranged from 1.5 to 16 cfs and in 2000 ranged from 18 to 36 cfs (Socolow *et al.* 2000 and Socolow *et al.* 2001). It should be noted that 1999 was a drought year. Average monthly flows in June were lower than have been recorded in decades (USGS 5 June 2001).

The Norwell Water Department and Mass American Water Company withdraw over 4 MGD of water from this subwatershed for municipal supply.

Chemistry – water

Also as part of the MWI grant project, USGS sampled the Weir River at the Route 3A bridge, Hingham between June 1999 and June 2000. Parameters measured included dissolved oxygen, temperature, ammonia-nitrogen, and phosphorus.

DO

Dissolved oxygen concentrations ranged between 6.2 and 11.3 mg/L (n=10) No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings were below the SWQS for a class SA waterbody (n=10).

pH

pH ranged from 6.2 to 7.1 SU and was only below 6.5 SU on one occasion (n=10).

Ammonia-Nitrogen (as N)

Ammonia-Nitrogen concentrations ranged from BDL to 0.102 mg/L (n=10). All measurements were below the acute and chronic water quality criteria for ammonia-nitrogen.

Total Phosphorus (as P)

Total phosphorus levels ranged between 0.004 (estimated) and 0.044 mg/L (n=10).

Based on the high comparability to the regional reference station, the dominance of pollution intolerant species, and water chemistry data the *Aquatic Life Use* is assessed as support for this segment of the Weir River. The Weir River is however, on "Alert Status" due to the possible negative impacts from the sediment inputs to the river and reduced baseflows.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of the MWI99-02 grant project, USGS collected fecal coliform bacteria samples at the Route 3A bridge in Hingham (Socolow *et al.* 2000 and Socolow *et al.* 2001). Fecal coliform bacteria counts ranged from 25 to 570 cfu/100mL (n=10). Levels were above 400 cfu/100mL in two samples, both during the primary contact season.

Based on the intermittent elevated bacteria counts the *Primary Contact Recreational Use* is assessed as partial support. No fecal coliform counts were above 2,000 cfu/100mL, therefore, the *Secondary Contact Recreational Use* is assessed as support.

AESTHETICS

No obvious signs of aesthetic quality degradation were noted (i.e., no odors, trash/debris, or oily sheens). The water was clear with no observable turbidity (Appendix C).

Based on the overall high aesthetic quality and land use information this segment of the Weir River is assessed as support for the *Aesthetics Use*

Weir River (MA74-02) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	SUPPORT*				
Fish Consumption	NOT ASSESSED				
Primary Contact	PARTIAL SUPPORT	Pathogens		Unknown	
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

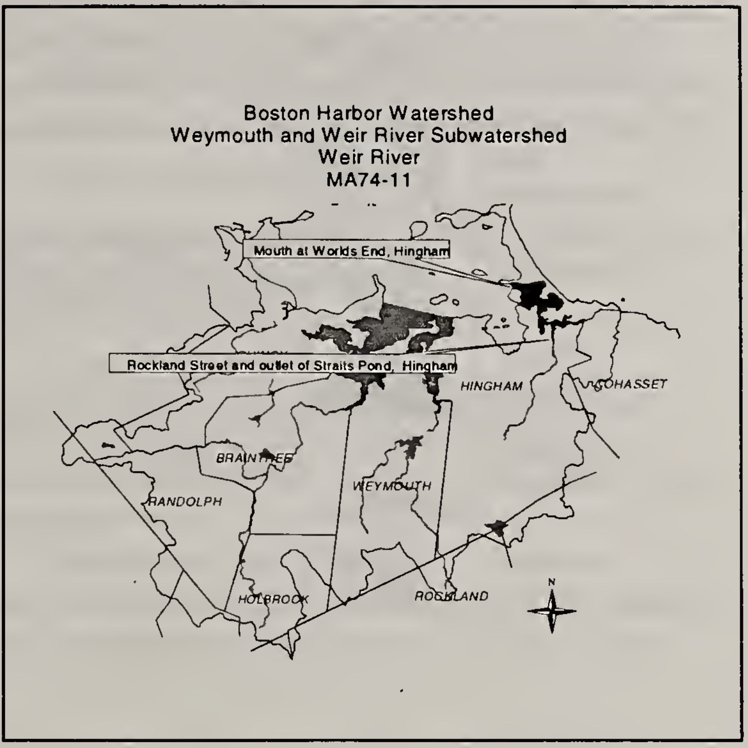
* "Alert Status" issues identified-- See the *Aquatic Life Use* assessment

RECOMMENDATIONS WEIR RIVER (MA74-02)

- As part of their new WMA permit, Mass American is required to maintain a stream gage on the Weir River. Review streamflow data to determine if water withdrawals are impacting habitat for the aquatic life by reducing baseflow in this segment of the Weir River.

WEIR RIVER (SEGMENT MA74-11)

Location: Rockland Street and outlet Straits Pond, Hingham to mouth at Worlds End, Hingham/Hull.
Segment Area: 1.0 mile.
Classification: Class SA, Shellfishing (Open)


Boston Harbor Watershed
Weymouth and Weir River Subwatershed
Weir River
MA74-11
Mouth at Worlds End, Hingham
Rockland Street and outlet of Straits Pond, Hingham
HINGHAM
COHASSET
BRAINTREE
RANDOLPH
WEYMOUTH
HOLBROOK
ROCKLAND
N

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). The Weir River herring fishery was established in 1805. It is currently much reduced and best quantified as a remnant population. The largest potential spawning area, Accord Pond, is used as a water supply by the town of Hingham. The Weir River herring run is managed under the Town of Hingham regulations with approval by the Commonwealth through the Division of Marine Fisheries. This system has historically supported a strong Rainbow smelt population and an active fishery in Hingham Bay. The run was so large that it has served as a source of smelt eggs for propagation programs by both the Division of Marine Fisheries and the Division of Fisheries and Game in both inland and coastal waters and for cooperative programs with other states (Brady 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.3, GBH1.4, GBH1.5 and GBH1.7 are conditionally restricted and GBH1.0 and GBH1.6 are prohibited (DFWELE 2000).

Based on this information the *Shellfishing Use* is assessed as partial support for 0.52 mi^2 and non-support for 0.48 mi^2 of this segment of the Weir River.

Weir River (MA74-11) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.52 mi^2 NON-SUPPORT 0.48 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		NOT ASSESSED				
Secondary Contact		NOT ASSESSED				
Aesthetics		NOT ASSESSED				

WEYMOUTH AND WEIR SUBWATERSHED - LAKE ASSESSMENTS

A total of 27 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned PALIS code numbers in the Weymouth and Weir Subwatershed (Ackerman 1989 and MA DEP 2001b). These lakes represent a total surface area for the Weymouth and Weir Subwatershed lakes of 1,204.3 acres. They range in size from 0.7 to 329 acres; only five lakes are greater than 50 acres and, of those, three are greater than 200 acres.

No data/information were available to assess the *Aquatic Life*, *Recreational,* and *Aesthetics* uses for the lakes in the Weymouth and Weir Subwatershed. They are all currently not assessed.

FISH CONSUMPTION

The MDPH fish consumption advisory list contains the status of each water body for which an advisory has been issued. If a water body is not on the list it may either be because an advisory was not warranted or the water body has not been sampled. MDPH's most current Fish Consumption Advisory list is available online at http://www.state.ma.us/dph/beha/fishlist.htm.

The MDPH Fish Consumption List includes two ponds in the Weymouth and Weir Subwatershed because of elevated levels of pesticides in fish tissue. The advisories recommend the following (MDPH 2001a):

Icehouse Pond, Randolph, Holbrook, Braintree

1. Children under 12, pregnant women and nursing mothers should not eat any fish from Icehouse Pond.
2. The general public should not consume any of the affected fish species (Brown Bullhead, Carp, American Eel) from Icehouse Pond.
3. The general public should limit consumption of non-affected fish from Icehouse Pond to two meals per month.

Sylvan Lake, Randolph, Holbrook, Braintree

1. Children under 12, pregnant women and nursing mothers should not eat any fish from Sylvan Lake.
2. The general public should not consume any of the affected fish species (Brown Bullhead, Carp, American Eel) from Sylvan Lake.
3. The general public should limit consumption of non-affected fish from Sylvan Lake to two meals per month.

These two ponds, Icehouse Pond in Holbrook/Braintree and Sylvan Lake in Randolph/Holbrook/Braintree, are impaired (non-support due to pesticides) for the *Fish Consumption Use* (Table 12). No other lakes in the Weymouth and Weir Subwatershed currently have individual fish consumption advisories, so they are not assessed.

In July 2001, MDPH issued new statewide consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."

Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. The statewide advisory encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* for lakes in the Weymouth and Weir Subwatershed cannot be assessed as support or partial support.

Table12 presents the use assessments for the lakes in the Weymouth and Weir Subwatershed.

RECOMMENDATIONS – LAKES

- Coordinate with DEM and/or other groups conducting lake surveys to generate quality assured lake data. Conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds, they should be eliminated or, at least, minimized through the application of appropriate point or non-point source control techniques.

- Review data from "Beaches Bill" required water quality testing (bacteria sampling from all formal bathing beaches) to assess the status of the recreational uses; e.g., Sunset Lake (Braintree), Whitmans Pond (Weymouth).

- Review DEP Drinking Water Program Source Water Assessment Program evaluations when they are completed to develop and implement recommendations for the protection of Class A waterbodies in the Weymouth and Weir Subwatershed including Great Pond, Upper Reservoir, Whitmans Pond, Richardi Reservoir, Weymouth Great Pond (Great Pond), Accord Pond, and Accord Brook.

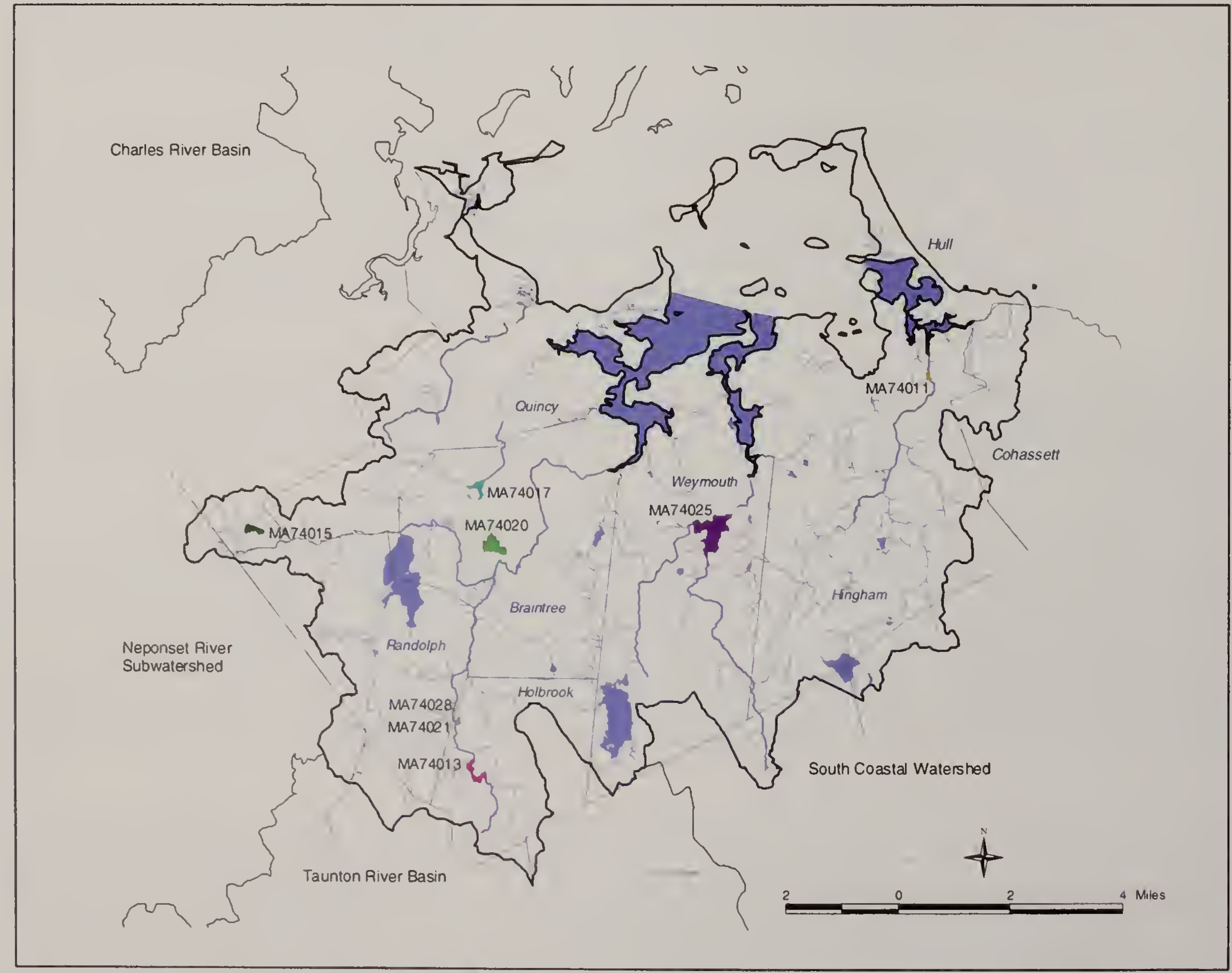


Figure 19. Lake Segments in the Weymouth and Weir Subwatershed

Table 12. Weymouth and Weir River Basins Lakes Assessments (**Bold** indicates 1998 303(d) listed waters.)

LAKE	Waterbody Identification Code WBID	SIZE Acres	Aquatic Life (Causes)	Fish Consumption (Causes)	Primary Contact (Causes)	Secondary Contact (Causes)	Aesthetics (Causes)
Foundry Pond, Hingham	MA74011	8.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Lake Holbrook, Holbrook	MA74013	36.6	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Hoosicwhisick Pond, Milton	MA74015	23.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Old Quincy Reservoir, Braintree	MA74017	36.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Sunset Lake, Braintree	MA74020	57.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Sylvan Lake, Holbrook	MA74021	2.0	Not Assessed	2.00 acres Non-support (Pesticides)	Not Assessed	Not Assessed	Not Assessed
Whitmans Pond, Weymouth	MA74025	210.0	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Ice House Pond, Randolph	MA74028	0.70	Not Assessed	0.70 acres NON-SUPPORT (Pesticides)	Not Assessed	Not Assessed	Not Assessed

BOSTON HARBOR – ESTUARINE SEGMENT ASSESSMENTS

Winthrop Bay (Segment MA70-10) 230
Boston Inner Harbor (MA70-02) 233
Pleasure Bay (Segment MA70-11) 238
Dorchester Bay (Segment MA70-03) 240
Quincy Bay (Segment MA70-04) 245
Quincy Bay (Segment MA70-05) 248
Hingham Harbor (Segment MA70-08) 252
Hingham Bay (Segment MA70-06) 254
Hingham Bay (Segment MA70-07) 257
Hull Bay (Segment MA70-09) 260
Boston Harbor (Segment MA70-01) 262

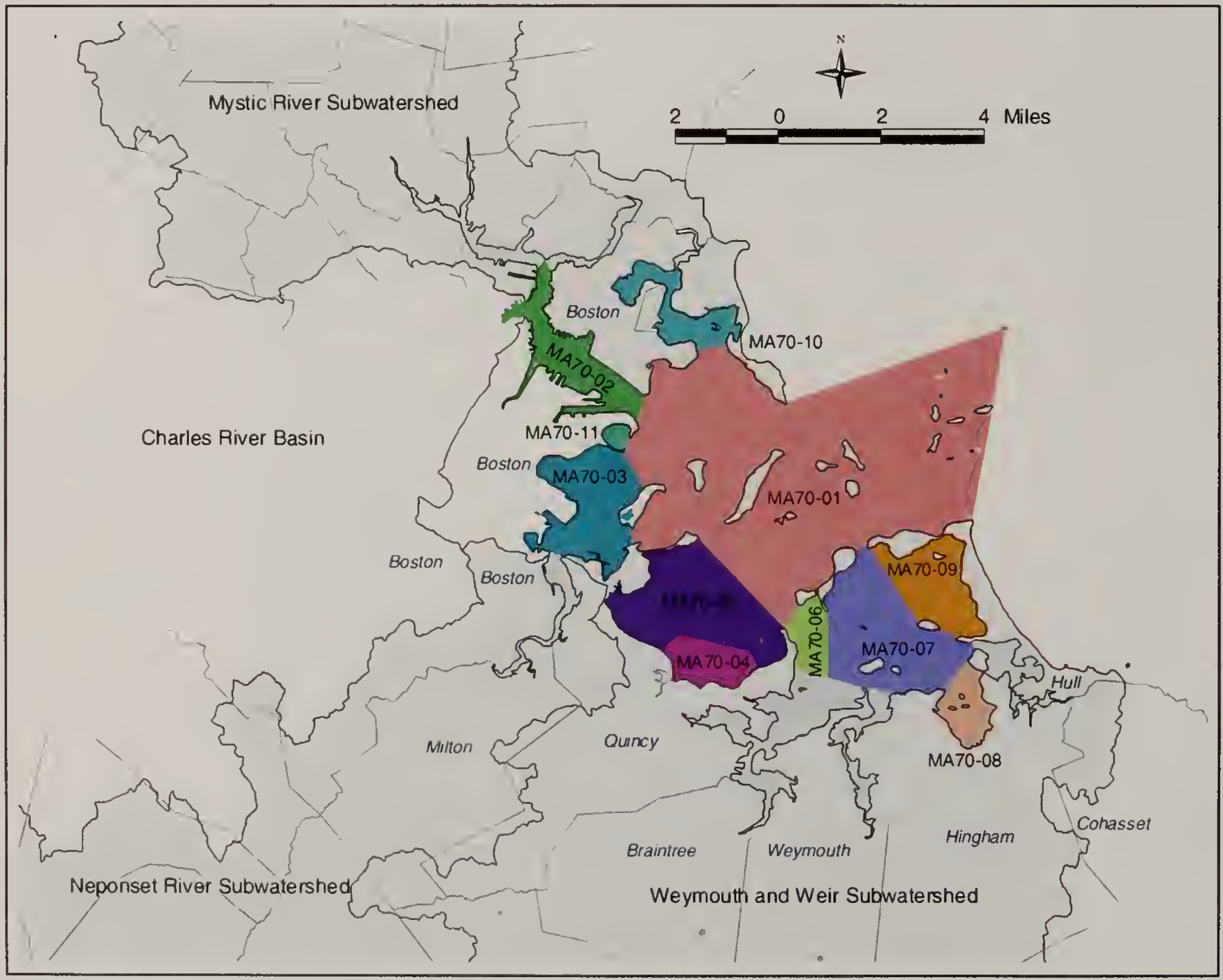


Figure 20. Estuarine segments in Boston Harbor (Proper)

GENERAL ISSUES/RECOMMENDATIONS FOR BOSTON HARBOR (PROPER)

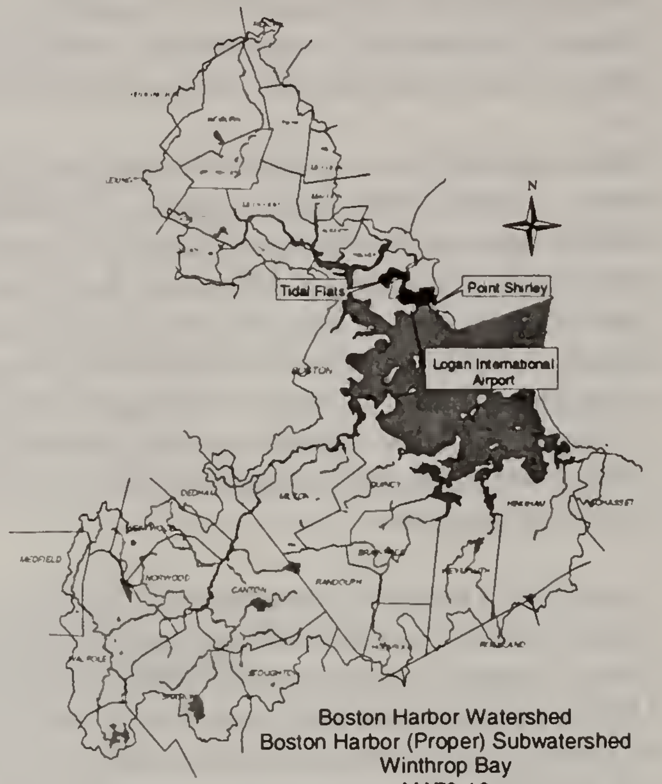
The majority of metropolitan Boston's municipal and industrial waste is treated at the MWRA Deer Island WWTP and is discharged 9.5 miles out into Massachusetts Bay. However, there are significant contributions of wastewater to the harbor in the form of permitted CSOs (MWRA and Boston Water and Sewer Commission), storm water, construction dewatering from the Big Dig, discharges from two major power plants, and NCCW from the Gillette Company.

Water quantity is an important issue throughout the Boston Harbor Watershed. The majority of public water, whether from local supplies or through the interbasin transfer of water from Quabbin Reservoir in central Massachusetts by the MWRA, is processed at the MWRA's Deer Island Wastewater Treatment Plant and discharged to Massachusetts Bay. Recharge of the local systems is mainly limited to precipitation events and low streamflow is a serious problem. This loss of water essentially reduces available streamflow, and threatens instream uses such as aquatic life, habitat quality and quantity and recreational uses. Strong conservation measures through implementation strategies such as block rate pricing, installation of water- saving devices in homes and public buildings, in concert with a strong educational program, will all help reduce the stress placed on the water resources throughout the Boston Harbor Watershed.

The Boston Harbor Association with financial support of the Massachusetts Port Authority, the mayor's office, the City of Boston Environment Department, the Massachusetts Water Resources Authority, the United States Environmental Protection Agency, the Massachusetts Environmental Trust, and the Massachusetts Coastal Zone Management, initiated the Boston Harbor Marine Debris Salvage Program to clean up the waterfront and inner tributaries of Boston Harbor. This project has led to efforts to curtail the entrance of debris from the shore to the harbor. The Boston Conservation Commission and the MA DEP have developed certain conditions to keep waterfront construction debris from entering the harbor. Numerous cleanup projects along the Charles River, the Mystic River, and harbor beaches have also resulted (East Boston 21 August 2000).

WINTHROP BAY (SEGMENT MA70-10)

Location: From the tidal flats at Coleridge Street, East Boston to a line between Logan International Airport and Point Shirley, East Boston/Winthrop.
Segment Area: 1.5 square miles.
Classification: Class SB Shellfishing (Restricted)



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Winthrop Bay
MA70-10

More than 2,200 acres of Boson Harbor have been filled in (including Bird Island Flats) to expand Logan International Airport to its present size of 2,400 acres (MassPort 2002). This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). There is one vessel sewage pump-out facility located within this segment: Atlantis Marina (CZM 3 October 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

Logan MassPort has an individual storm water permit (MA0000787) for four major outfalls to Winthrop Bay. The permit is expected to be reissued in 2002. Since March 15, 1982, Logan's sanitary wastewater has been processed by the MWRA.

Boston Water and Sewer with MWRA funds has completed sewer separation work in the Constitution Beach section of East Boston. The facility discharged screened and disinfected CSO flows approximately 16 times per year. As of October 2000 the Constitution Beach CSO was eliminated and the Constitution Beach CSO Treatment Facility was decommissioned (Coughlin and Stanley 2001).

USE ASSESSMENT

AQUATIC LIFE

Chemistry - water

As part of their ongoing CSO monitoring program, MWRA collected monthly surface and bottom water quality samples (DO, temperature, turbidity, Chlorophyll *a* and TSS) from 1998 to 2000 at station 130 - Winthrop Harbor, green can #1(Coughlin 2001a).

DO

Dissolved oxygen concentrations were not below 5.0 mg/L in either the surface or bottom waters during any of the sampling events (range 5.32 – 11.68 mg/L; n=262). Additionally, percent saturation levels were below 75% on only 10 occasions and were above 115% on 19 occasions (range 67.1 – 140.1%; n=265). It should be noted that the majority of the low DO concentrations were recorded in the bottom waters and the high percent saturations were recorded in the surface waters. No measurements were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

No temperature readings (n=273) were above the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were taken on 100 occasions with levels ranging between 0 and 39.9 NTU.

Chlorophyll a

Chlorophyll *a* measurements were taken on 204 occasions. The bottom concentrations ranged from 0.59 to 33.7 µg/L and surface concentrations ranged from 0.57 to 36.9 µg/L.

Total Suspended Solids

TSS measurements at station 130 were taken on 202 occasions. Bottom concentrations ranged from 1.3 to 15.5 mg/L and surface concentrations ranged from 0.6 to 21.4 mg/L.

Water chemistry parameters (DO, temperature, water clarity, and chlorophyll *a)* were generally within the SWQS for a Class SB waterbody, therefore the *Aquatic Life Use* is assessed as support.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH5.1, GBH5.2, GBH5.4, and GBH5.5 are conditionally restricted and shellfish growing areas GBH5.0, GBH5.10, GBH5.11, GBH5.12, and GBH5.9 are prohibited (DFWELE 2000).

Based on the conditionally restricted and prohibited shellfish growing area status the *Shellfishing Use* is assessed as partial support for 0.62 mi^2 and non-support for 0.88 mi^2 of this segment of Winthrop Bay.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of their ongoing CSO monitoring program, MWRA recorded 72 Secchi disk depths between 1998-2000 at station 130 - Winthrop Harbor, green can #1 (Coughlin 2001a). Secchi disk depths ranged from 0.8 to 5.2 m with only ten of the 165 measurements below the SWQS of 1.2 m (on one occasion the Secchi disk could be seen to the bottom). Additionally, between 1998-2000, as part of the CSO monitoring program, MWRA collected 249 fecal coliform bacteria samples from this station. Bacteria counts ranged from <5 to 1,250 cfu/100mL with only four samples above 400 cfu/100mL.

The MWRA collected daily fecal coliform bacteria samples between 12 June 1996 and 3 September 2000 at three stations on Constitution Beach: MDC16 North; MDC17 Bathhouse; MDC18 South. At these three stations, bacteria counts ranged from <5 to 61,600 cfu/100mL. Percentages of counts above the *Primary* and *Secondary Recreational Use* guidance are presented below in Table 13. On 15 occasions bacteria counts were greater than 4,000 cfu/100mL: four dates in 1996, three dates in 1998, one date in 1999, and one date in 2000. The high bacteria counts were generally associated with wet weather. Additionally, between 1996 and 2000, the MDC issued 51 bathing advisories for Constitution Beach.

Table 13. Percentages Of Bacteria Count Above The *Recreational Use* Guidance Collected By MWRA From Three Stations At MDC's Constitution Beach

Station	**Percent greater than 400 cfu/100mL**	**Percent greater than 2000 cfu/100mL**	**Percent greater than 4000 cfu/100mL**
MDC16 (n=349)	9%	3%	2%
MDC17 (n=350)	9%	2%	1%
MDC18 (n=350)	9%	1%	1%

Boston Water and Sewer Commission with MWRA funds has completed sewer separation work in the Constitution Beach section of East Boston. The facility discharged screened and disinfected CSO flows approximately 16 times per year. As of October 2000 the Constitution Beach CSO was eliminated and the Constitution Beach CSO Treatment Facility was decommissioned (Coughlin and Stanley 2001).

Although the geometric means of fecal coliform bacteria were low, there were intermittent periods of elevated bacteria. Based on elevated fecal coliform bacteria counts during wet weather conditions and swimming advisories, the *Primary* and *Secondary Contact Recreational* uses are assessed as partial support.

AESTHETICS

As part of their ongoing CSO monitoring program, MWRA recorded Secchi disk depths in Winthrop Bay (see Primary and Secondary Contact Recreation above). Water clarity was good. Additionally, the bay is usually free from trash/debris and objectionable odors.

Based on the high aesthetic quality of Winthrop Bay, it is assessed as support for the *Aesthetics Use.*

Winthrop Bay (MA70-10) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.62 mi^2 NON-SUPPORT 0.88 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		PARTIAL SUPPORT	Pathogens		CSO, unknown	Urban runoff/storm sewers
Secondary Contact		PARTIAL SUPPORT	Pathogens		CSO, unknown	Urban runoff/storm sewers
Aesthetics		SUPPORT				

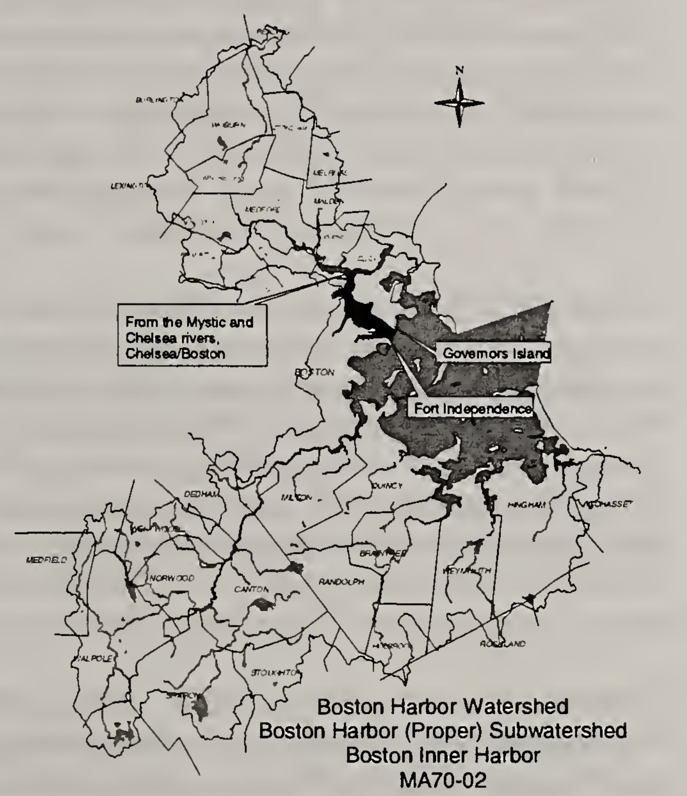
RECOMMENDATIONS WINTHROP BAY (MA70-10)

- Continue to review MWRAs fecal coliform bacteria data to evaluate the effectiveness of the CSO elimination at Constitution Beach.

- Track progress of the Boston Water and Sewer Commission and Logan MassPort storm water management plans and implementation of best management practices.

BOSTON INNER HARBOR (MA70-02)

Location: From the Mystic and Chelsea rivers, Chelsea/Boston, to the line between Governors Island and Fort Independence, East Boston/Boston (including Fort Point and Reserved channels, and Little Mystic River.)
Segment Area: 2.3 square miles.
Classification: Class SB, CSO*
(* In the updated 2002 SWQS, this segment will be reclassified to SB_{CSO}. See Classification section.)



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Boston Inner Harbor
MA70-02

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). There are four vessel sewage pump put facilities located within the Boston Inner Harbor: Boston Waterboat Marina, Long Wharf; Constitution Marina; Shipyard Quarters Marina; and Marina at Rowes Wharf (CZM 3 October 2001).

In mid-summer 1998, the wastewater previously treated at the MWRA Nut Island facility was transferred, via a deep-rock tunnel, to the Deer Island facility. This transfer, through the 'inter-island tunnel', ended more than 50 years of discharges of primary treated wastewater to the South Harbor, and increased flows of secondary treated wastewater to the outer North Harbor. Wastewater is now discharged via a deep ocean outfall to Massachusetts Bay. In a *Comparison of Water Quality in Boston Harbor Before and After Inter-island Transfer* MWRA compared data collected from 14 sampling stations in Boston Harbor (north harbor and south harbor) before and after the inter-island transfer. In each region, sampling was conducted at two sets of stations: 'outfall stations' - in the immediate vicinity of the outfalls of the two treatment facilities and 'receiving-water stations' - located further afield, away from the outfalls. The report focused on three water quality issues: symptoms of eutrophication of the Boston Harbor water column (nutrient concentrations, standing stocks of phytoplankton, and dissolved oxygen), water clarity and concentrations of solids in the water column, and counts of sewage indicator bacteria in the water column (Taylor 2001).

In the South Harbor, the region where the wastewater discharges were discontinued, nitrogen and Phosphorus concentrations were generally lower after transfer than before while in the North Harbor (the region that received the discharges added from Nut Island) N and P concentrations were generally greater after transfer than before. The spatial patterns of changes in water clarity within the two regions suggested that the effects of inter-island transfer were smaller for these variables than for N and P, and were focused around the outfalls in the regions. In both the South and North harbors, DO percent saturation values in the bottom waters were significantly lower after transfer. In the South Harbor, (at the former Nut Island outfalls and in the region), average counts of both fecal coliform and Enterococcus bacteria were lower after transfer. In the North Harbor, no significant increases in counts of either type of bacterium were observed at the Deer Island outfalls. The North Harbor as a whole, however, showed a significant decrease in Enterococcus, and two stations showed decreased counts of fecal coliform bacteria (Taylor 2001).

WMA WATER WITHDRAWAL SUMMARY:

There are no water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

Boston Inner Harbor will be classified as SB_{CSO} water body under the 2002 updated Massachusetts Surface Water Quality Standards. The discharge of CSO is authorized in accordance with the final CSO Facilities Plan. Thirty-six CSO outfalls were identified in the CSO Facilities Plan in the Inner Harbor (as defined in the WQS). These CSOs are permitted to MWRA, Boston Water & Sewer Commission, and the

City of Chelsea. The approved Facilities Plan includes a combination of sewer separation, CSO storage, and CSO treatment facilities. These improvements will eliminate seven of these CSO outfalls, and substantially mitigate CSO discharges at all other outfalls (CSO discharges to Constitution Beach have already been eliminated). The MWRA owns and operates two existing CSO treatment facilities in this subwatershed, which will remain active: the Prison Point and Somerville Marginal facilities. Two additional MWRA CSO treatment facilities will be constructed at Union Park at the Fort Point Channel in Boston and at the Reserved Channel in South Boston to treat CSO prior to discharge. Discharges from active CSO outfalls will be limited to the frequency and volume established for a typical year under recommended plan conditions in the approved CSO Facilities Plan; discharges from active untreated outfalls are expected to occur less than four times per year on an average basis when the planned facilities are constructed. Floatables controls will be provided for all active CSO outfalls.

Under NPDES permit number MA0103284, MWRA is permitted (issued 2001) to discharge combined sewage from the Prison Point CSO Treatment Facility (MWR 203) to Boston Inner Harbor. The facility is required to conduct and report on the results of two whole effluent toxicity tests annually. This outfall also has average discharge event TRC limits of 0.1 mg/L. MWRA has upgraded the facility to improve treatment performance and meet new residual chlorine discharge limits. At this facility MWRA began using the upgraded chlorination and new dechlorination equipment in manual mode since October 2000. MWRA expects to complete improvement to this facility and have full system acceptance by Spring 2001 (Coughlin and Stanley 2001). In October 2000 and March 2001 the facility analyzed the TRC concentrations of their discharge, which were above the permit limit in 2000.

Gillette Company – Safety Razor Division (MA0003832) is permitted to discharge 53.1 MGD of NCCW to this segment of Boston Harbor. The existing permit includes a maximum temperature limit of 83°F. The permit is currently (2001) being reissued with Gillette seeking an increase in flow.

Massachusetts Highway Department (MA0033928) is permitted to discharge construction dewatering via 45 outfalls to Boston Harbor Proper. The permit includes both dry and wet weather monitoring requirements and limits. Under this permit, a SWPPP is required. The permit expires 21 December 2002.

Massachusetts Bay Transit Authority (MBTA)- South Boston Piers/Transitway Project (MA0036781) is permitted to discharge construction dewatering via eight outfalls to Fort Port Channel. The permit has a TSS limit of 100 mg/L (average) and a 250 mg/L daily maximum: and a TPH limit of 5 mg/L. The permit also requires a Best Management Practices (BMP) Plan and expires 12 August 2002.

Coastal Oil N.E. Inc., formerly known as Belcher of New England, (MA0004405) is permitted to discharge treated storm water via outfall 001 and 30 GPM of treated groundwater via outfall 002 to the Reserved Channel. The permit includes a TSS limit of 30 mg/L. The permit expires in 30 January 2005.

New England Aquarium (MA0003123) is permitted to discharge 200,000 GPD of treated effluent to this segment of Boston Harbor. The permit includes limits for TSS (30mg/L), TRC (1.0 mg/L) and requires two whole effluent toxicity tests per year with an $LC_{50} \geq 100\%$. The permit expires January 2006.

Seaboard Enterprises Inc. (MA0024988), Boston Shipyard (MA0003484), and the U.S. Navy Department Supervisor of Ships (MA0029424) are listed on the EPA October 2000 active list.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

As part of the MWRA 2000 fish and shellfish monitoring program caged blue mussels *(Mytilus edulis*), from Rockport were deployed at Boston Inner Harbor to evaluate bioaccumulation potential. Mussel survival within the deployed arrays from Boston Inner Harbor was high (96%). The 2000 data were similar to previous years with the highest body burdens of contaminants observed in mussels deployed in Boston Inner Harbor. The 2000 contaminant levels (total PCBs, pesticides, total PAHs, mercury, and lead), like other monitoring years, were well below the federal action limits and indicate no risk for human consumption (Lefkovitz et al. 2001).

Toxicity

Effluent

In October 2000 and March 2001, MWRA Deer Island (MA0103284) conducted two whole effluent toxicity tests using the mysid shrimp, *Mysidopsis bahia* and the inland silverside, *Menidia beryllina* on the Prison Point CSO outfall. The CSO discharges were not acutely toxic to the shrimp or fish in either test event.

Chemistry - water

As part of their ongoing CSO monitoring program, MWRA collected monthly surface and bottom water quality samples (DO, temperature, turbidity, Chlorophyll *a* and TSS) at seven sites on this segment between 1996 and 2000 (Coughlin 2001a):

- 014 Inner Harbor, mouth Charles, Coast Guard Base
- 015 Inner Harbor, Confluence Mystic/ Chelsea Rivers
- 018 Inner Harbor, Fort Point Channel at Summer Street
- 019 Inner Harbor, off mouth of Fort Point Channel
- 022 Inner Harbor, Reserved Channel Middle
- 024 Inner Harbor, Mouth of Harbor, R Buoy 10
- 138 Inner Harbor, off New England Aquarium

DO

Dissolved oxygen concentrations (at the seven stations) were below 5.0 mg/L on only 33 occasions (range 0.87-14.89 mg/L n=1,947). Percent saturations (range 9.79-152.4%; n=1,946) were below 75% on 202 occasions (10%) and above 115% on 57 occasions. No measurements were collected pre-dawn and, therefore, these data do not represent worst-case conditions.

Temperature

All temperature readings (n=2,041) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity at the seven stations ranged from 0 to 424 NTU with an average of 6.28 NTU (n=1,026).

Chlorophyll a

Chlorophyll *a* collected from stations 024 and 138 (n= 373) ranged from 0.15 to 49.6 µg/L.

Total Suspended Solids

TSS concentrations at stations 024 and 138 (n=714) ranged from 0.5 to 12 mg/L in the surface and in the bottom concentrations ranged from 1.3 to 41.4 mg/L.

Water chemistry data collected at multiple stations over multiple years was generally within the SWQS for a Class SB waterbody, therefore, the *Aquatic Life Use* is assessed as support. However, because of the highly industrialized/developed nature of the Inner Harbor and multiple active CSO discharges, this segment is on "Alert Status".

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels…
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves…"

Based on the MDPH seafood fish consumption advisory for Boston Harbor, the *Fish Consumption Use* is assessed as non-support for this entire segment.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH4.0 and GBH6.0 are prohibited (DFWELE 2000b).

Based on the prohibited status of the shellfish growing areas, the *Shellfishing Use* is assessed as non-support for 2.3 mi^2 of Boston Inner Harbor.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

MWRA collected fecal coliform bacteria samples at station 138 (n=376) and at station 024 (n=375) between 1996 and 2000 as part of their ongoing CSO monitoring program (Coughlin 2001b). At station 138 (near the New England Aquarium) fecal coliform bacteria counts ranged from <5 to 9,160 cfu/100mL (wet weather) with 20 counts above 400 cfu/100mL (5%). At station 024, the mouth of the Inner Harbor, fecal coliform bacteria counts ranged from <5 to 5,600 cfu/100mL (wet weather) with ten counts above 400 cfu/100mL (3%).

Additionally, MWRA recorded Secchi disk depths at all seven of the water quality stations on this segment from 1996-2001(Coughlin 2001b). Secchi disk depths ranged from 0.5 to 5.6 m with 20 of the 932 measurements not meeting the SWQS of 1.2 m.

Fecal coliform bacteria levels were generally low at the two stations in Boston Inner Harbor. Exceedances were neither frequent nor prolonged; therefore, the *Primary* and *Secondary Contact Recreational* uses are assessed as support. The Inner Harbor is, however, on "Alert Status" due to large potential for bacterial contamination from this urban subwatershed (e.g., CSOs, storm water, and illicit sewer connections).

AESTHETICS

As part of their ongoing CSO monitoring program, MWRA recorded Secchi disk depths in Boston Inner Harbor (see Primary and Secondary Contact Recreation above). Only infrequent excursions (2%) of the Secchi disk depth criterion were noted.

More than 130 barrels of small debris, 300 pieces of large debris, and 30 pieces of piers and other oversized debris were collected between July 1, 2000 and September 15, 2000 during the pilot year of the Boston Harbor Marine Debris Salvage Program. Debris was collected from "high activity areas" such as the downtown waterfront, the Charlestown Navy Yard, the East Boston waterfront, South Boston waterfront, the Outer Fort Point Channel, and Chelsea Creek. In 2001, the second year of this program, more than 57 tons were collected (East Boston 2000).

The *Aesthetics Use* is assessed as support because the trash and debris associated with this urban watershed is currently being managed by the Marine Debris Salvage Program. However, this segment is on "Alert Status" due to the quantity of trash and debris collected and the potential for aesthetic quality degradation.

Boston Inner Harbor (MA70-02) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	SUPPORT*				
Fish Consumption	NON-SUPPORT	Priority organics		Unknown	
Shellfishing	NON-SUPPORT 2.3 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact*	SUPPORT*				
Secondary Contact*	SUPPORT*				
Aesthetics*	SUPPORT*				

* "Alert Status" issues identified, see the *Aquatic Life, Primary* and *Secondary Contact Recreation,* and *Aesthetics* uses

RECOMMENDATIONS BOSTON INNER HARBOR (MA70-02)

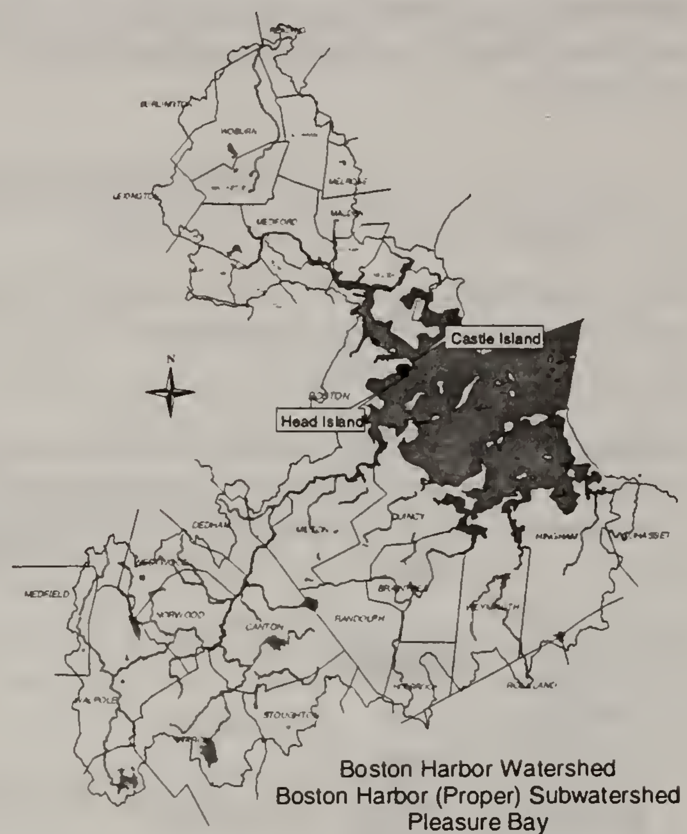
- Continue to review MWRAs fecal coliform bacteria data to evaluate the effectiveness of the CSO abatement program.
- Track progress of storm water management plans and implementation of best management practices.
- Work with local citizens to promote good stewardship of the waterfront including education outreach programs and waterfront clean-ups.
- Continue to support the Boston Harbor Marine Debris Salvage Program.
- Review results of the MWRA's *Final 1998 CSO Sediment Synthesis Report.*

PLEASURE BAY (SEGMENT MA70-11)

Location: A semi-enclosed bay, the flow restricted through two channels between Castle and Head islands, Boston.
Segment Area: 0.22 square miles.
Classification: Class SB Shellfishing (Restricted).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Pleasure Bay
MA70-11

USE ASSESSMENT

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory for Boston Harbor, the *Fish Consumption Use* is assessed as non-support for this entire segment.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH3.7 is under a management closure (DFWELE 2000b).

Based on the management closure the *Shellfishing Use* is not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

The MWRA collected weekly fecal coliform bacteria samples at stations MDC20 Pleasure Bay, Broadway from 1996 to 2000 (Coughlin 2001b). At this station, bacteria counts (n=183) ranged from <5 to 1,440 cfu/100mL (dry weather). On only five occasions bacteria counts were greater than 400 cfu/100mL (3%). Additionally, between 1996 and 2000, the MDC issued 15 bathing beach advisories for Pleasure Bay beach (Coughlin and Stanley 2001).

Since there were 15 bathing beach advisories issued for Pleasure Bay, the *Primary Contact Recreational* Use is assessed as partial support. However, based on the fact that no fecal coliform bacteria counts were greater than 2,000 cfu/100mL, the *Secondary Contact Recreational Use* is assessed as support.

Pleasure Bay (MA70-11) Use Summary Table

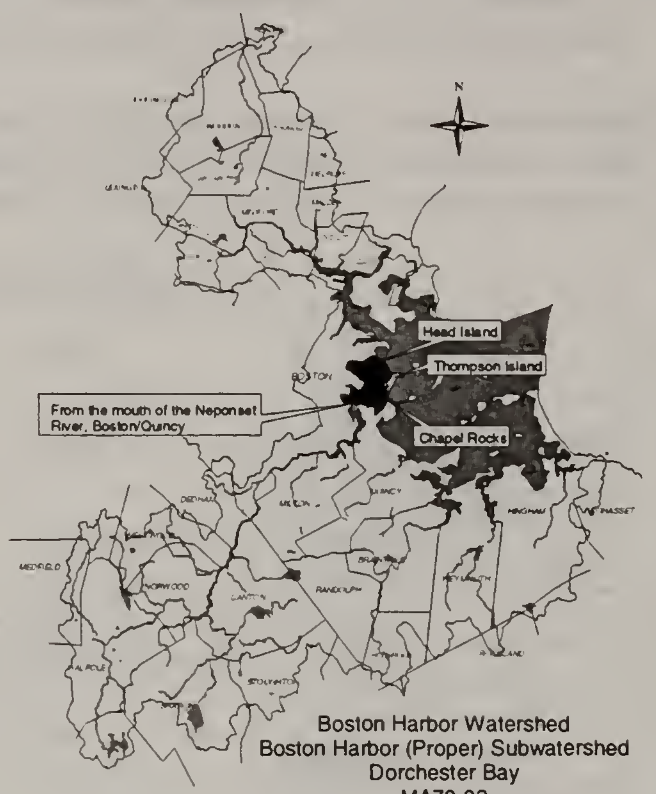
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED				
Fish Consumption		NON-SUPPORT	Priority organics		Unknown	
Shellfishing		NOT ASSESSED For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		PARTIAL SUPPORT	Pathogens		Unknown	Urban runoff/storm sewers
Secondary Contact		SUPPORT				
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS PLEASURE BAY (MA70-11)

- Continue to review MWRAs fecal coliform bacteria data to evaluate the effectiveness of the CSO abatement program.
- Track progress of the Boston Water and Sewer, MWRA, and municipal storm water management plans and implementation of best management practices.
- Work with local citizens to promote good stewardship of the waterfront including education outreach programs and waterfront clean-ups.

DORCHESTER BAY (SEGMENT MA70-03)

Location: From the mouth of the Neponset River, Boston/Quincy to the line between Head Island and the north side of Thompson Island and the line between the south point of Thompson Island and Chapel Rocks, Boston/Quincy.
Segment Area: 4.6 square miles.
Classification: Class SB Shellfishing (Restricted), CSO*.
(* In the updated 2002 SWQS, the CSO designation will be removed from Dorchester Bay. See Classification section.)



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Dorchester Bay
MA70-03

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). There is one vessel sewage pump-out facility located at Marina Bay on this segment (CZM 3 October 2001).

In a *Comparison of Water Quality in Boston Harbor Before and After Inter-island Transfer* MWRA presents data collected from 14 sampling stations in Boston Harbor divided into two regions (north harbor and south harbor). In each region, sampling was conducted at two sets of stations: 'outfall stations' - in the immediate vicinity of the outfalls of the two treatment facilities and 'receiving-water stations' - located further afield, away from the outfalls. The report focused on three water quality issues: symptoms of eutrophication of the Boston Harbor water column (nutrient concentrations, standing stocks of phytoplankton, and dissolved oxygen), water clarity and concentrations of solids in the water column, and counts of sewage indicator bacteria in the water column (Taylor 2001).

WMA WATER WITHDRAWAL

There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

In northern Dorchester Bay, there are presently seven CSO outfalls which discharge to areas adjacent to Carson and L Street Beaches. The approved CSO plan includes construction of a consolidation and storage conduit, which will eliminate these CSO discharges. The conduit is also being sized to collect storm water runoff presently discharging to the beach areas, which are contributing to use impairments. Flows in excess of the storage capacity will be discharged after treatment to the Reserved Channel. The project, however, has encountered serious permitting difficulties and is behind the court schedule at this time. MWRA is presently developing additional planning level documents, which will be subject to public environmental review in the MEPA process, to assess the feasibility of the existing approved plan and other CSO control alternatives (Brander 2001a).

In southern Dorchester Bay, MWRA currently owns and operates the Fox Point (MWR 209) and Commercial Point (MWR 211) CSO Treatment Facilities. These facilities provide screening, chlorination and dechlorination of CSO flows prior to discharges to Dorchester Bay. The MWRA, in coordination with the Boston Water and Sewer Commission and in accordance with the approved CSO Facilities Plan, Federal Court Order, and Water Quality Standards is proceeding with a sewer separation program in the sewersheds tributary to these facilities, which will ultimately eliminate CSO discharges through these facilities. These facilities are therefore considered interim facilities, which will remain in operation until the extensive sewer separation work necessary to eliminate CSO discharges is completed in November 2008 (Brander 2001a).

Under NPDES permit number MA0103284, MWRA is permitted (issued 2001) to discharge combined sewage from the Fox Point CSO Treatment Facility (MWR 209) and the Commercial Point CSO

Treatment Facility (MWR 211) to Dorchester Bay. The facilities are required to conduct and report on the results of two whole effluent toxicity tests annually from each outfall. These outfalls also have average discharge event TRC limits of 0.1 mg/L. MWRA has upgraded both CSO treatment facilities through the construction of new chlorination and dechlorination buildings.

Boston Water & Sewer Commission (BWSC) (MA01011992) is permitted to discharge combined sewage via seven outfalls (BOS 081 through BOS 087) to North Dorchester Bay. [It should be noted that BWSC outfalls 088 and 089 are the same as MWRA's outfalls 209 and 211.] BWSC has historically discharged 9.03 MG of untreated CSO discharge to Dorchester Bay-North via outfalls BOS 081-BOS 087. These outfalls will be eliminated under the MWRA North Dorchester Bay/Reserved Channel CSO Project as part of the approved 1997 MWRA CSO Facilities Plan.

The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

MWRA began its studies of infaunal communities and benthic habitats in Boston Harbor in 1991, just prior to the cessation of sludge dumping into the Harbor (Kropp *et al.* 2000). In 1998 sediments at station T04, inner Dorchester Bay, appeared to be hypoxic with gas voids indicative of high rates of bacterial activity and organic matter. Benthic habitat conditions improved at this station in 1999. Station T04 appeared to be organically enriched with dark-gray silty sediments. The benthic community structure at station T04 consistently showed signs of being the most stressed of all harbor stations, probably resulting from physical processes and high rates of sediment accumulation and organic enrichment. Organic content of sediment was highest of all MWRA's stations at T04. Values for infaunal abundance, species numbers, diversity, and evenness in April and August 1999 generally were similar to those estimated for the previous two years.

Toxicity

Effluent

In March 2001, MWRA Deer Island (MA0103284) conducted two whole effluent toxicity tests using the mysid shrimp, *M. bahia* and the inland silverside, *M. beryllina* on both the Fox Point and on the Commercial Point CSO outfalls. The CSO discharges were not acutely toxic to the shrimp or fish in either test event from either outfall.

Chemistry - water

As part of their ongoing CSO monitoring program, MWRA collected monthly water quality samples (DO, temperature, turbidity, Chlorophyll *a* and TSS) at six sites on this segment of Dorchester Bay between 1996 and 2000 (Coughlin 2001b):

- 033, North Dorchester Bay, Carson Beach off L St.
- 036, North Dorchester Bay, Carson Beach off Bathhouse
- 038, Northern Dorchester Bay
- 040, South Dorchester Bay, Malibu Bay
- 084, South Dorchester Bay, Columbia Pt at Buoy 12
- 140, South Dorchester Bay, Columbia Point/Savin Hill Cove

DO

Dissolved oxygen concentrations were not below 5.0 mg/L at any station in the surface or bottom waters during the sampling events (range 5.09 – 15.45 mg/L; n=1,107). Percent saturation levels were never below 60% (range 65.1 – 144.6%; n=1,114) and were above 115% on 72 occasions (6%). No samples were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings (n=1,150) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity ranged from 0 to 114 NTU with an average of 5.84 NTU (n=576).

Chlorophyll a

Chlorophyll *a* samples were collected on 366 occasions at station 140. Concentrations ranged from 0.3 to 49.2 µg/L.

Total Suspended Solids

TSS samples were collected on 359 occasions at station 140. Concentrations ranged from 0.3 to 39.2 mg/L with only one greater than 25 mg/L.

Although the benthic community structure showed signs of stress (at the one MWRA sampling location), water chemistry data from the six sampling locations in Dorchester Bay identified no obvious signs of water quality impairment. The *Aquatic Life Use* is, therefore, assessed as support for the entire 4.6 mi^2 of Dorchester Bay. The Bay is, however, on "Alert Status" due to the possible nutrient and sediment inputs from multiple CSOs.

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory, the *Fish Consumption Use* is assessed as non-support for Dorchester Bay.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH3.2 is conditionally restricted, shellfish growing area GBH3.6 is closed seasonally for management, and shellfish growing areas GBH3.0, GBH3.3, and GBH3.5 are prohibited (DFWELE 2000b).

Based on the status of the shellfish growing areas in Dorchester Bay, 0.52 mi^2 are assessed as partial support, 4.03 mi^2 are assessed as non-support. Due to the management closure, 0.05 mi^2 of Dorchester Bay are not assessed at this time. .

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Dorchester Bay receives the flow from ten BWSC CSO outfalls and from two MWRA CSO Treatment facilities. The MWRA collected 366 fecal coliform bacteria samples from south Dorchester Bay, Columbia Point/Savin Hill Cove (station 140) between 1996 and 2000 as part of their ongoing CSO monitoring program. Fecal coliform bacteria counts ranged from <5 to 9,160 cfu/100mL with 20 counts above 400 cfu/100mL (5%) and only one above 4,000 cfu/100mL. As part of this project, MWRA also recorded Secchi disk depths at the six water quality stations (033, 036, 038, 040, 084, and 140) throughout this segment of Dorchester Bay. Secchi disk depths ranged from 0.4 to 3.9 m with 124 of the 657 measurements less than 1.2 m (19%). It should be noted that on 40 occasions the Secchi disk was seen all the way to the bottom (Coughlin 2001b).

As part of the MWRA/MDC bathing beach monitoring, weekly fecal coliform bacteria samples were collected during the primary contact recreation season (1996 through 2000) at six stations within this segment: MDC21, Carson Beach, M Street; MDC22, Carson Beach at I St.; MDC23, Carson Beach Bathhouse; MDC24, Malibu Beach Bathhouse; MDC25, Savin Hill Beach Bayside; MDC39, Beades Bridge (Coughlin 2001a). Percentages of counts above the *Primary* and *Secondary Recreational Use* guidance are presented below in Table 14. At these stations, bacteria counts ranged from <5 to 47,200 cfu/100mL (n=1,277). On 12 occasions bacteria counts were greater than 4,000 cfu/100mL (1%). The majority of these high bacteria counts were associated with wet weather.

Table 14. Percentages Of Bacteria Count Above The *Recreational Use* Guidance Collected By MWRA From Six Stations At MDC's Bathing Beaches.

Station	Percent greater than 400 cfu/100mL	Percent greater than 2000 cfu/100mL	Percent greater than 4000 cfu/100mL
MDC21 (n=355)	3%	<1%	0
MDC22 (n=353)	7%	<1%	<1%
MDC23 (n=354)	7%	2%	2%
MDC24 (n=81)	12%	5%	1%
MDC25 (n=77)	13%	5%	4%
MDC39 (n=57)	12%	5%	0

Additionally, between 1996 and 2000, the MDC issued 28 bathing beach advisories for Carson Beach (averaged data from three stations), 24 advisories for Malibu Beach (one station), and 27 advisories for Savin Hill Beach (one station) (Coughlin and Stanley 2001).

Although the geometric means of fecal coliform bacteria were low, there were intermittent periods of elevated bacteria. Based on elevated fecal coliform bacteria counts during wet weather conditions (CSOs), poor water clarity (Secchi disk transparency) and swimming advisories, the *Primary* and *Secondary Contact Recreational* uses are assessed as partial support.

AESTHETICS

Dorchester Bay presently receives the flow from seven BWSC CSO outfalls and from two MWRA CSO Treatment facilities. MWRAs turbidity and TSS samples from six sites on Dorchester Bay indicated relatively low turbidity, however, Secchi disk depth transparencies were frequently below 1.2 m (Coughlin 2001a). Additionally, sunken barges and trash/debris have been observed at various locations on this segment (Chretien 2002).

Based on the intermittent low water clarity of Dorchester Bay, and the negative impacts of multiple CSO discharges, and intermittent areas of trash and debris, the *Aesthetic Use* is assessed as partial support.

Dorchester Bay (MA70-03) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		SUPPORT*				
Fish Consumption		NON-SUPPORT	Priority organics		Unknown	
Shellfishing		PARTIAL SUPPORT 0.52 mi^2 NON-SUPPORT 4.03 mi^2 NOT ASSESSED 0.05 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		PARTIAL SUPPORT	Pathogens		CSO	
Secondary Contact		PARTIAL SUPPORT	Pathogens		CSO	
Aesthetics		PARTIAL SUPPORT	Turbidity, suspended solids, trash and debris		CSO	

* "Alert Status" Issues identified – see *Aquatic Life Use* Assessment

RECOMMENDATIONS DORCHESTER BAY (SEGMENT MA70-03)

- Continue to review MWRAs fecal coliform bacteria data to evaluate water quality and the effectiveness of CSO abatement projects.

- Work with local citizens to promote good stewardship of the waterfront including education outreach programs and waterfront clean-ups.

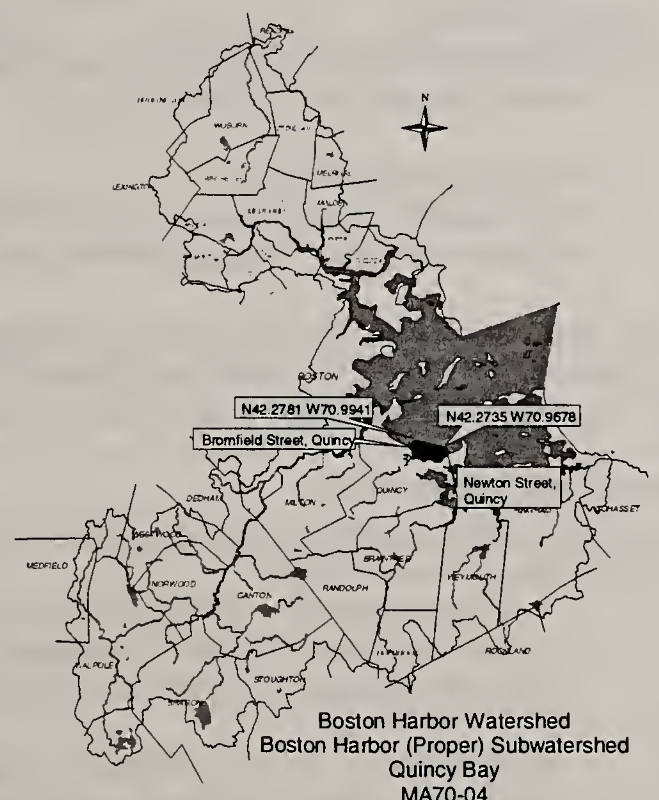
- The benthic substrates near the Fox Point CSO discharge appear to be suffering the impacts of increased nutrients and hypoxic sediments. Conduct water column nutrient monitoring in Dorchester Bay to determine if sediments are also increasing the water column nutrient levels.

- Track progress of Boston Water and Sewer storm water management programs and implementation of best management practices.

- Review results of the MWRA's *Final 1998 CSO Sediment Synthesis Report.*

QUINCY BAY (SEGMENT MA70-04)

Location: From Bromfield Street near the Wallaston Yacht Club, Quincy, northeast to N42.2781 W70.9941, southeast to N42.2735 W70.9678, and south to Newton Street on the northerly shore of Houghs Neck, Quincy.
Segment Area: 1.0 square miles.
Classification: Class SA, Shellfishing (Open), CSO*.
(* In the next SWQS, the CSO designation will be removed from Quincy Bay. See Classification section.)



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Quincy Bay
MA70-04

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

In a *Comparison of Water Quality in Boston Harbor Before and After Inter-island Transfer* MWRA presents data collected from 14 sampling stations in Boston Harbor divided into two regions (north harbor and south harbor). In each region, sampling was conducted at two sets of stations: 'outfall stations' - in the immediate vicinity of the outfalls of the two treatment facilities and 'receiving-water stations' - located further afield, away from the outfalls. The report focused on three water quality issues: symptoms of eutrophication of the Boston Harbor water column (nutrient concentrations, standing stocks of phytoplankton, and dissolved oxygen), water clarity and concentrations of solids in the water column, and counts of sewage indicator bacteria in the water column (Taylor 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

As part of their ongoing receiving water monitoring program, MWRA collected monthly water quality samples (DO, temperature, turbidity, Chlorophyll *a* and TSS) at station 077, Quincy Bay, off Merrymount Park (Coughlin 2001a):

DO

Dissolved oxygen concentrations were only below 5.0 mg/L in the surface or bottom waters on two occasions (range 0.59 – 14.26 mg/L; n=341). Additionally, percent saturation levels were below 60% on only one occasion and above 115% on 19 occasions (range 7.8 – 148.5%; n=341). No measurements were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings (n=362) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were recorded on 183 occasions in the surface and bottom waters. Levels ranged between 0 and 503 NTU with an average of 7.94 NTU.

Chlorophyll a

Chlorophyll *a* samples were collected on 367 occasions. Concentrations in the surface and bottom waters ranged from 0.16 to 27.1 µg/L.

Total Suspended Solids

TSS samples were collected on 351 occasions. Concentrations in the surface and bottom waters ranged from 0.5 to 75 mg/L with only three greater than 25 mg/L.

The water quality monitoring data (i.e., DO, temperature, turbidity) collected over multiple years indicated no extreme or prolonged violations of the SWQS for a Class SB waterbody, therefore, this segment of Quincy Bay is assessed as support for the *Aquatic Life Use*.

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory for Boston Harbor, the *Fish Consumption Use* is assessed as non-support for this entire segment.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH2.1 and GBH2.2 are conditionally restricted and shellfish growing area GBH2.0 is prohibited (DFWELE 2000b).

Based on the shellfish growing area data, the *Shellfishing Use* is assessed as partial support for 0.36 mi^2 and non-support for 0.64 mi^2 of this segment of Quincy Bay.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Also as part of their ongoing receiving water monitoring program, MWRA collected fecal coliform bacteria samples from station 077, Quincy Bay, off Merrymount Park (Coughlin 2001a) from 1996-2000. Fecal coliform bacteria levels (n=374) ranged from <5 to 11,100 cfu/100mL (wet weather). Bacteria counts were above 400 cfu/100mL on 23 occasions and were greater than 4,000 cfu/100mL on only two occasions. Samples were collected during both wet and dry weather conditions. Additionally, 201 Secchi depth readings were recorded between 1996 and 2001 ranging from 0.7 to 4.8 m. Secchi disk readings were less than the SWQS of 1.2 m on only 12 occasions and could be seen all the way to the bottom on 18 occasions.

Based on multiple years of low fecal coliform bacteria counts during both wet and dry weather conditions and good water clarity the *Primary* and *Secondary Contact Recreational* uses are assessed as support for this segment of Quincy Bay.

AESTHETICS

MWRAs turbidity and TSS samples and Secchi disk depth from station 077, Quincy Bay, off Merrymount Park indicated relatively low turbidity with good water clarity (Coughlin 2001a).

Based on the good water quality and overall high aesthetic quality of this segment of Quincy Bay the *Aesthetic Use* is assessed as support.

Quincy Bay (MA70-04) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	SUPPORT				
Fish Consumption	NON-SUPPORT	Priority organics		Unknown	
Shellfishing	PARTIAL SUPPORT 0.36 mi^2 NON-SUPPORT 0.64 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact	SUPPORT				
Secondary Contact	SUPPORT				
Aesthetics	SUPPORT				

RECOMMENDATIONS QUINCY BAY (MA70-04)

- Continue to review MWRAs fecal coliform bacteria data when assessing the recreational uses.
- Track progress of municipal storm water management plans and implementation of best management practices.
- Investigate storm drain system to determine if illegal connections may be contributing bacteria to Quincy Bay.

QUINCY BAY (SEGMENT MA70-05)

Location: Quincy Bay, north of the class SA waters (segment MA70-04), Quincy to the line between Moon Head and Nut Island, Quincy
Segment Area: 4.7 square miles.
Classification: Class SB, Shellfishing (Restricted), CSO*.
(* In the next SWQS, the CSO designation will be removed from Quincy Bay. See Classification section.)

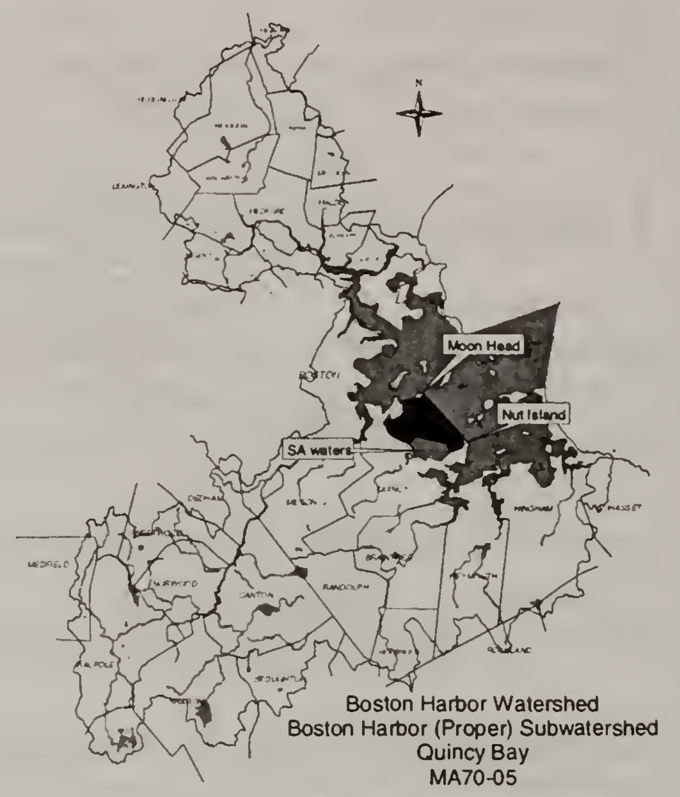
This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

WMA WATER WITHDRAWAL

There are no regulated water withdrawals from this segment.

SURFACE NPDES DISCHARGE SUMMARY:

MWRA Nut Island Headworks (MA0103268) is permitted to discharge storm water via outfalls 001 and 002 to Quincy Bay and Boston Harbor. This permit expired 14 December 1997. This facility discharged approximately 270 MGD of primary treated sanitary sewage into Quincy Bay. Discharges ended in July 1998 when the plant was converted to a headworks facility and flows were transferred to Deer Island (Coughlin and Stanley 2001).



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Quincy Bay
MA70-05

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

MWRA began its studies of infaunal communities and benthic habitats in Boston Harbor in 1991, just prior to the cessation of sludge dumping into the Harbor (Kropp *et al.* 2000). Sampling was conducted at one station, T07, on this segment of Quincy Bay. Values for infaunal abundance, species numbers, diversity, and evenness in April and August 1999 generally were similar to those estimated for the previous two years.

Chemistry - water

As part of their ongoing receiving water monitoring program, MWRA collected monthly water quality samples (DO, temperature, turbidity, Secchi, Chlorophyll *a* and TSS) at two sites on this segment of Quincy Bay between 1996 and 2000 (Coughlin 2001a): 047, Quincy Bay, Wollaston Beach at Sachem St.; 139, Quincy Bay, Hangmans Island.

DO

Dissolved oxygen concentrations were not below 5.0 mg/L at either station in the surface or bottom waters during any of the sampling events (range 5.51 – 13.68 mg/L; n=497). Additionally, percent saturation levels were not below 60%, however, they were above 115% on 22 occasions (range 69.5 – 134.2; n=497). No measurements were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings (n=532) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were taken on 267 occasions. Levels ranged between 0 and 799.4 NTU with an average of 7.18 NTU.

Chlorophyll a

Chlorophyll *a* measurements were taken on 366 occasions. Concentrations ranged from 0.24 to 26.99 µg/L.

Total Suspended Solids

TSS concentrations were collected on 359 occasions. Concentrations ranged from 0.5 to 48.2 mg/L with only two greater than 25 mg/L.

The water quality monitoring data (i.e., DO, temperature, turbidity) collected over multiple years indicated no extreme or prolonged violations of the SWQS for a Class SB waterbody, therefore, this segment of Quincy Bay is assessed as support for the *Aquatic Life Use.*

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels...
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves..."

Based on the MDPH seafood fish consumption advisory for Boston Harbor, the *Fish Consumption Use* is assessed as non-support for this entire segment.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH2.5 is conditionally restricted and shellfish growing areas GBH2.0, GBH2.3, GBH2.4, GBH2.6, and GBH2.7 are prohibited (DFWELE 2000b).

Based on shellfish growing area status, the *Shellfishing Use* is assessed as partial support 0.2 mi^2 and non-support for 4.5 mi^2 of this segment of Quincy Bay.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of their receiving water monitoring program, MWRA collected fecal coliform bacteria samples and recorded Secchi disk depths at the two water quality stations on this segment of Quincy Bay (Coughlin 2001a). Fecal coliform bacteria counts (n=512) ranged from <5 to 7,100 cfu/100mL (wet weather). Bacteria counts were greater than 400 cfu/100mL on 16 occasions and greater than 4,000 cfu/100mL on only two occasions. Secchi disk depth readings (n=310) ranged from 0.9 to 5.1m and were less than the SWQS of 1.2 m on only nine occasions. It should be noted that on 16 occasions the Secchi disk could be seen all the way to the bottom

The MWRA also collected weekly fecal coliform bacteria samples between 12 June 1996 and 21 September 2000 at four sites at Wollaston Beach: MDC29, Milton St.; MDC30, Sachem St.; MDC31, Channing St.; MDC32, Rice St. Percentages of counts above the *Primary* and *Secondary*

Recreational Use guidance are presented below in Table 15. At the four stations, bacteria counts ranged from <5 to 66,000 cfu/100mL (n=1605). Forty-nine bacteria counts were greater than 4,000 cfu/100mL. It should be noted that the high bacteria counts were generally not associated with wet weather. Bacteria counts were slightly lower at station MDC32 at Rice Street on Wollaston Beach.

Table 15. Percentages Of Bacteria Count Above The *Recreational Use* Guidance Collected By MWRA From Six Stations At MDC's Bathing Beaches.

Station	**Percent greater than 400 cfu/100mL**	**Percent greater than 2000 cfu/100mL**	**Percent greater than 4000 cfu/100mL**
MDC29 (n=398)	18%	7%	4%
MDC30 (n=402)	22%	8%	4%
MDC31 (n=404)	23%	6%	3%
MDC32 (n=401)	23%	6%	3%

Additionally, between 1996 and 2000, the MDC issued 593 bathing beach advisories for Wollston Beach (Coughlin and Stanley 2001).

It should be noted that eight storm drains that drain residential areas of East Quincy, discharge directly onto Wollaston Beach. The City of Quincy has spent more than $24 million on surveys, repairs, and rehabilitation to the sewer and storm drain system in the area of Wollaston Beach since 1994. Sewers near Rice Road were completely separated from the storm drains in 1997 and since 1998 extensive projects undertaken by the City include repairing cracked sewer lines and service connections, cleaning of outfalls, and increasing street and catch basin cleaning during the summer season. Additionally, prior to July 1998, this segment received approximately 270 MGD of primary treated sanitary sewage from the MWRA Nut Island Treatment Plant. The discharge is now conveyed through the inter-basin tunnel to the Deer Island WWTP and is discharged to Massachusetts Bay (Coughlin and Stanley 2001).

Based on the frequency of elevated fecal coliform bacteria counts during dry weather conditions and bathing beach closures the *Primary* and *Secondary Contact Recreational* uses are assessed as non-support.

Quincy Bay (MA70-05) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life*	SUPPORT*				
Fish Consumption	NON-SUPPORT	Priority organics		Unknown	
Shellfishing	PARTIAL SUPPORT 0.2 mi^2 NON-SUPPORT 4.50 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact	NON-SUPPORT	Pathogens		Urban runoff/storm sewers, municipal point source	
Secondary Contact	NON-SUPPORT	Pathogens		Urban runoff/storm sewers, municipal point source	
Aesthetics	NOT ASSESSED				

* "Alert Status" issues identified – See *Aquatic Life Use* Assessment

RECOMMENDATIONS QUINCY BAY (MA70-05)

- Work with the City of Quincy to continue to identify and remove illegal wastewater connections to storm drains and to investigate dry weather sources of fecal coliform bacteria.
- Continue to review MWRAs fecal coliform bacteria data to determine if the Quincy sewer work is improving water quality in Quincy Bay.
- Work with local citizens to promote good stewardship of the waterfront including education outreach programs and waterfront clean-ups.
- Review results of the MWRA's *Final 1998 CSO Sediment Synthesis Report*.

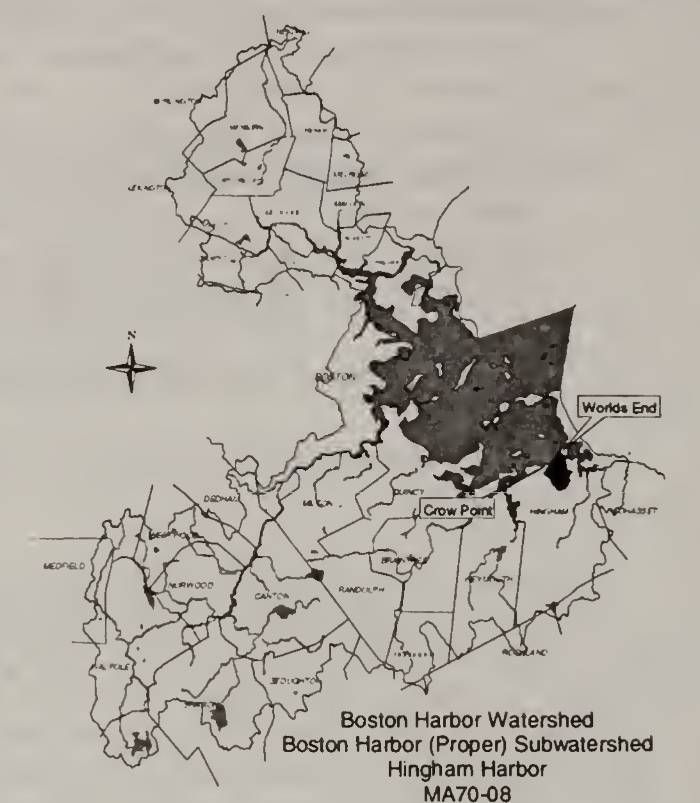
HINGHAM HARBOR (SEGMENT MA70-08)

Location: Hingham Harbor, in Hingham, inside a line from Crows Point to Worlds End, Hingham.
Segment Area: 1.1 square miles.
Classification: Class SA, Shellfishing (Open).

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a). There is one vessel sewage pump-out facility located on Hingham Harbor (CZM 3 October 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Hingham Harbor
MA70-08

USE ASSESSMENT

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH1.8 is conditionally restricted and shellfish growing areas GBH1.0, GBH1.19, and GBH1.28 are prohibited (DFWELE 2000).

Based on the shellfish growing area status, the *Shellfishing Use* is assessed as partial support for 0.49 mi^2 and non-support for 0.61 mi^2 for Hingham Harbor.

Hingham Harbor (MA70-08) Use Summary Table

Designated Uses	Status	Causes		Sources	
		Known	Suspected	Known	Suspected
Aquatic Life	NOT ASSESSED				
Fish Consumption	NOT ASSESSED				
Shellfishing	PARTIAL SUPPORT 0.49 mi^2 NON-SUPPORT 0.61 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact	NOT ASSESSED				
Secondary Contact	NOT ASSESSED				
Aesthetics	NOT ASSESSED				

RECOMMENDATIONS HINGHAM HARBOR (MA70-08)

- Conduct bacteria monitoring in Hingham Harbor to determine if the bacteria causing the closure of the shellfish growing areas is also impairing the recreational uses. Additionally, identify and eliminate sources causing the closure of the shellfish beds. Suspected causes include faulty septic systems, sewage discharges from boats, and illicit connections.

- Work with CZM and the EOEA Watershed Team to educate boaters about vessel sewage pump-out facilities and transfer procedures.

- Determine if suspected failing septic systems in Hingham have been repaired.

- Track progress of municipal storm water management plans and implementation of best management practices.

HINGHAM BAY (SEGMENT MA70-06)

Location: The area north of the mouth of the Weymouth Fore River extending on the west along the line between Nut Island and the south point of West Head, and on the east side along a line from Prince Head just east of Pig Rock to the mouth of the Weymouth Fore River (midway between Lower Neck and Manot Beach), Quincy.
Segment Area: 1.0 square miles.
Classification: Class SB, Shellfishing (Restricted)

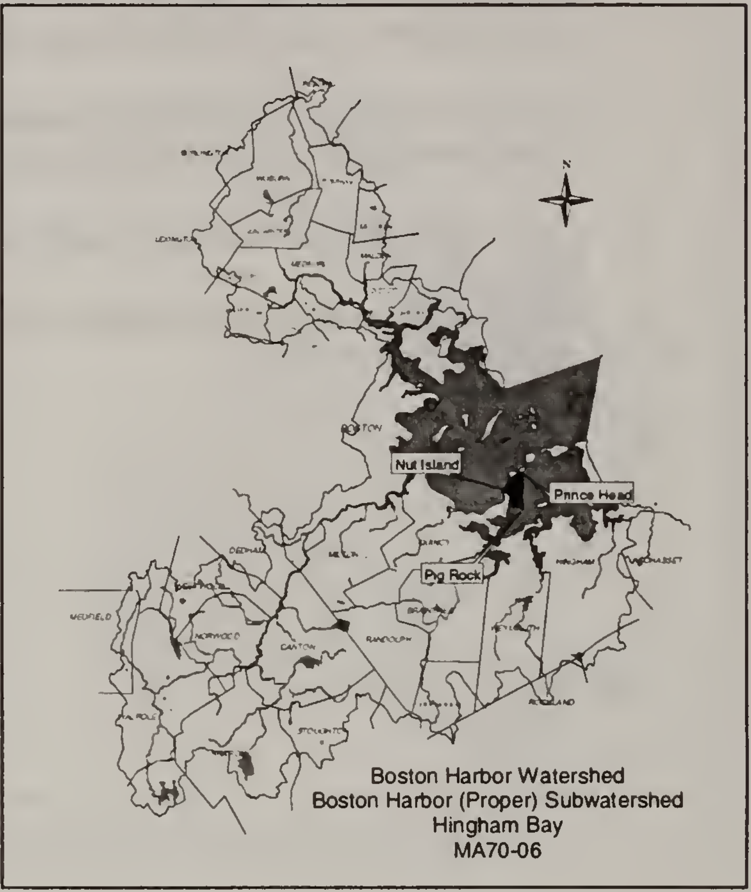
This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP. 1999).

WMA WATER WITHDRAWAL:

There are no regulated water withdrawals from Hingham Bay.

SURFACE NPDES DISCHARGE SUMMARY:

MWRA Nut Island (MA0102351) was permitted to discharge from POTW outfalls 001, 002, 003, 004, and 005 to Boston Harbor; outfalls 101,102, and 103 to Boston Harbor/Quincy Bay; and outfall 104 to Hingham Bay. The Nut Island Treatment Plant Emergency Relief Outfall (104) was permitted to discharge continuously for flow rates above 250 MGD and/or high tides to Hingham Bay. The permit was issued in December 1986 and remained effective until the new Deer Island Treatment Plant permit (MA0103284) was issued in May of 1999.



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Hingham Bay
MA70-06

MWRA Nut Island Headworks (MA0103268) is permitted to discharge storm water via outfalls 001 and 002 to Quincy Bay and Boston Harbor. This permit expired 14 December 1997. The facility no longer discharges, however, they still maintain an emergency discharge.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Chemistry - water

As part of their ongoing CSO monitoring program, MWRA collected monthly water quality samples (DO, temperature, and percent saturation) at one site (080 Quincy Bay, Quincy Yacht Club, Red Buoy #2) between 1996 and 2000 from this segment of Hingham Bay (Coughlin 2001a):

DO

Dissolved oxygen concentrations were below 5.0 mg/L on only one occasion (n=122; range 1.22-12.87 mg/L). Additionally, percent saturation levels were only below 60% on one occasion (n= 122; range 15.5-123.5%). No measurements were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings (n=135) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were taken on 70 occasions. Levels ranged between 0 and 809.9 NTU with an average of 21.06 NTU.

Chlorophyll a

Chlorophyll *a* measurements were taken on 90 occasions. Concentrations ranged from 4.16 to 38.4 µg/L.

Total Suspended Solids

TSS concentrations were collected on 90 occasions. Concentrations ranged from 0.8 to 24.4 mg/L.

Based on the available water chemistry data (DO, temperature, water clarity, and chlorophyll *a*), the *Aquatic Life Use* is assessed as support for this segment of Hingham Harbor.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH1.27 is closed seasonally for management and shellfish growing areas GBH1.0 and GBH2.0 are prohibited (DFWELE 2000).

Based on the shellfish growing area information the *Shellfishing Use* is assessed as non-support for 0.99 mi^2 of this segment Hingham Bay. Due to a management closure, 0.01 mi^2 of this segment of Hingham Bay are currently not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Between 1996 and 2000, MWRA collected fecal coliform bacteria samples and recorded Secchi disk depths at one site (080 Quincy Bay, Quincy Yacht Club, Red Buoy #2) as part of their ongoing CSO monitoring program (Coughlin 2001a). Fecal coliform bacteria counts were less than 5 cfu/100mL in all samples. Bacteria samples were collected during both wet and dry weather conditions. Secchi disk depths (n=109) ranged from 1 to 4.5 m with only three readings less than SWQS of 1.2 m. The disk was seen on the bottom on one occasion.

Based on the low fecal coliform bacteria counts and good water clarity the *Primary Contact* and *Secondary Contact Recreational* uses are assessed as support for this segment of Hingham Bay.

AESTHETICS

MWRAs turbidity and TSS samples and Secchi disk depth from station 080, Quincy Yacht Club, Red Buoy #2) indicated relatively low instream turbidity with good water clarity (Coughlin 2001a).

Based on the good water quality and overall high aesthetic quality of this segment of Hingham Bay the *Aesthetic Use* is assessed as support.

Hingham Bay (MA70-06) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Shellfishing		NOT ASSESSED 0.01 mi^2 NON-SUPPORT 0.99 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

RECOMMENDATIONS HINGHAM BAY (MA70-06)

- Track progress of municipal storm water management plan and implementation of best management practices.
- Conduct a bacterial/pathogenic source differentiation study to determine the source of bacteria causing the closure of the shellfish growing areas.

HINGHAM BAY (SEGMENT MA70-07)

Location: The area defined between Peddocks Island and Windmill Point; from Windmill Point southeast to Bumkin Island; from Bumkin Island southeast to Sunset Point; from Sunset Point across the mouth of the Weir River to Worlds End; from Worlds End across the mouth of Hingham Harbor to Crow Point; from Beach Lane, Hingham across the mouth of the Weymouth Back River to Lower Neck; and from Lower Neck midway across the mouth of the Weymouth Fore River.
Segment Area: 5.8 square miles.
Classification: Class SB Shellfishing (Restricted).

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

In a *Comparison of Water Quality in Boston Harbor Before and After Inter-island Transfer* MWRA presents data collected from 14 sampling stations in Boston Harbor divided into two regions (north harbor and south harbor). In each region, sampling was conducted at two sets of stations: 'outfall stations' - in the immediate vicinity of the outfalls of the two treatment facilities and 'receiving-water stations' - located further afield, away from the outfalls. The report focused on three water quality issues: symptoms of eutrophication of the Boston Harbor water column (nutrient concentrations, standing stocks of phytoplankton, and dissolved oxygen), water clarity and concentrations of solids in the water column, and counts of sewage indicator bacteria in the water column (Taylor 2001).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

MWRA began its studies of infaunal communities and benthic habitats in Boston Harbor in 1991, just prior to the cessation of sludge dumping into the Harbor (Kropp *et al.* 2000). Sampling was conducted at one station, T08, on this segment of Hingham Bay. Values for infaunal abundance, species numbers, diversity, and evenness in April and August 1999 generally were similar to those estimated for the previous two years.

Chemistry - water

As part of their ongoing receiving water monitoring program, MWRA collected monthly water quality samples (DO, temperature, turbidity, chlorophyll *a* and TSS) at two sites on this segment of Hingham Bay between 1996 and 2000: 117 - Hingham/Hull Bay, green Can #1; 124 - Hingham Bay, Crow Point Flats (Coughlin 2001a).

DO

Dissolved oxygen concentrations were not below 5.0 mg/L at either station in the surface or bottom waters during any of the sampling events (range 5.8 –14.1 mg/L; n=470). Additionally, percent saturation levels were not below 60% on any occasion, however, on 17 occasions it was greater than 115% (range 72.1 – 130.1%; n=471). No measurements were collected pre-dawn and, therefore, do not represent a worst-case scenario.

Temperature

All temperature readings (n=502) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity measurements were taken on 253 occasions ranging from 0 to 589.9 NTU with an average of 6.37 NTU.

Chlorophyll a

Chlorophyll *a* measurements (n=175) ranged from 0.22 to 39.3 µg/L in the surface and bottom waters.

Total Suspended Solids

TSS measurements (n=171) ranged from 1 to 45.1 mg/L with only one greater than 25 mg/L.

The water quality monitoring data (i.e., DO, temperature, turbidity) collected over multiple years at two stations indicated no prolonged violations of the SWQS for a Class SB waterbody, therefore, this segment of Hingham Bay is assessed as support for the *Aquatic Life Use.*

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.3, GBH1.8 and GBH1.9 are conditionally restricted and shellfish growing areas GBH1.0, GBH1.16, GBH1.17, and GBH1.18 are prohibited (DFWELE 2000b).

Based on the DMF Shellfish Status Report, the *Shellfishing Use* is assessed as partial support for 0.15 mi^2 and non-support for 5.65 mi^2 of this segment of Hingham Bay.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of their ongoing receiving water monitoring program, MWRA also collected fecal coliform bacteria samples and recorded Secchi disk depths at the two water quality stations on this segment of Hingham Bay between 1996 and 2000 (Coughlin 2001a). Fecal coliform bacteria counts (n=485) ranged from <5 to 4,400 cfu/100mL with 12 samples greater than 400 cfu/100mL (3%) and one sample greater than 4,000 cfu/100mL(wet weather). Bacteria samples were collected during both wet and dry weather conditions. Secchi disk depth readings (n=183) ranged from 0.9 to 5.7m. On only four occasions the depths were less than the SWQS of 1.2 m and the Secchi disk could be seen all the way to the bottom on eight occasions.

Based on the low fecal coliform bacteria counts (only isolated instances of SWQS exceedances) and good water clarity, the *Primary* and *Secondary Contact Recreational* uses are assessed as support for this segment of Hingham Bay.

AESTHETICS

MWRAs turbidity and TSS samples and Secchi disk depths indicated relatively low turbidity with good water clarity (Coughlin 2001a).

Based on the good water quality and overall high aesthetic quality of this segment of Hingham Bay the *Aesthetic Use* is assessed as support.

Hingham Bay (MA70-07) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.15 mi^2 NON-SUPPORT 5.65 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		SUPPORT				

RECOMMENDATIONS HINGHAM BAY (MA70-07)

- Conduct a bacterial/pathogenic source differentiation study to determine the source of bacteria causing the closure of the shellfish growing areas.
- Track progress of municipal storm water management plans and implementation of best management practices.

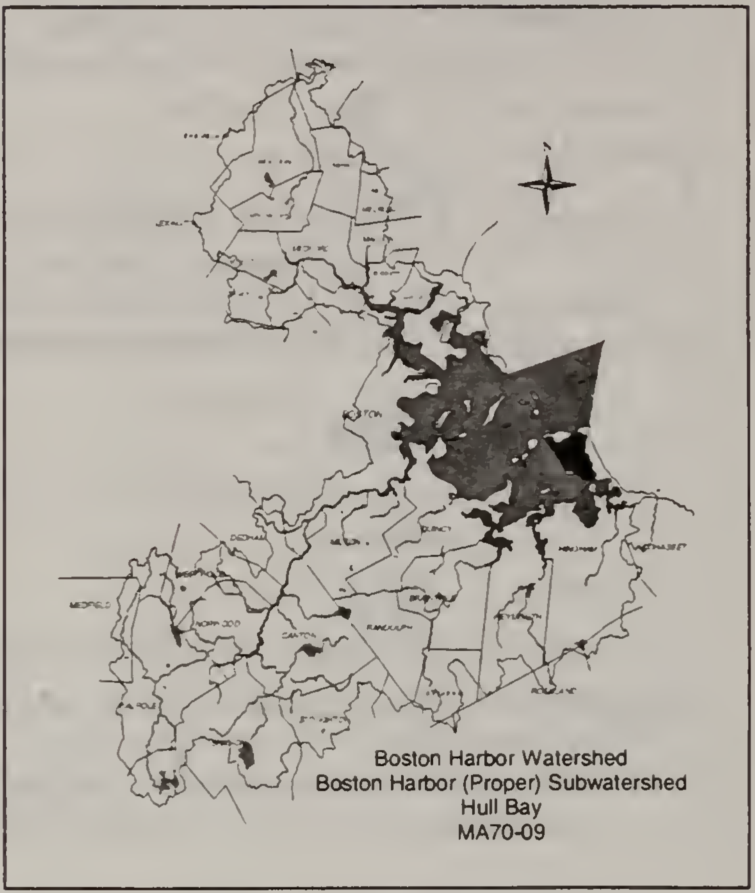
HULL BAY (SEGMENT MA70-09)

Location: The area defined east of a line from Windmill Point to Bumpkin Island and from Bumpkin Island to Sunset Point, Hull.
Segment Area: 2.3 square miles.
Classification: Class SB, Shellfishing (Restricted).

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY:

There are no regulated water withdrawals or wastewater discharges in this segment. However, all communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).



Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Hull Bay
MA70-09

USE ASSESSMENT

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas GBH1.1 and GBH1.2 are conditionally restricted and GBH1.0 and GBH1.17 are prohibited (DFWELE 2000b).

Based on the DMF Shellfish Status Report the *Shellfishing Use* is assessed as partial support for 0.25 mi^2 and non-support for 2.05 mi^2 of this segment of Hull Bay.

Hull Bay (MA70-09) Use Summary Table

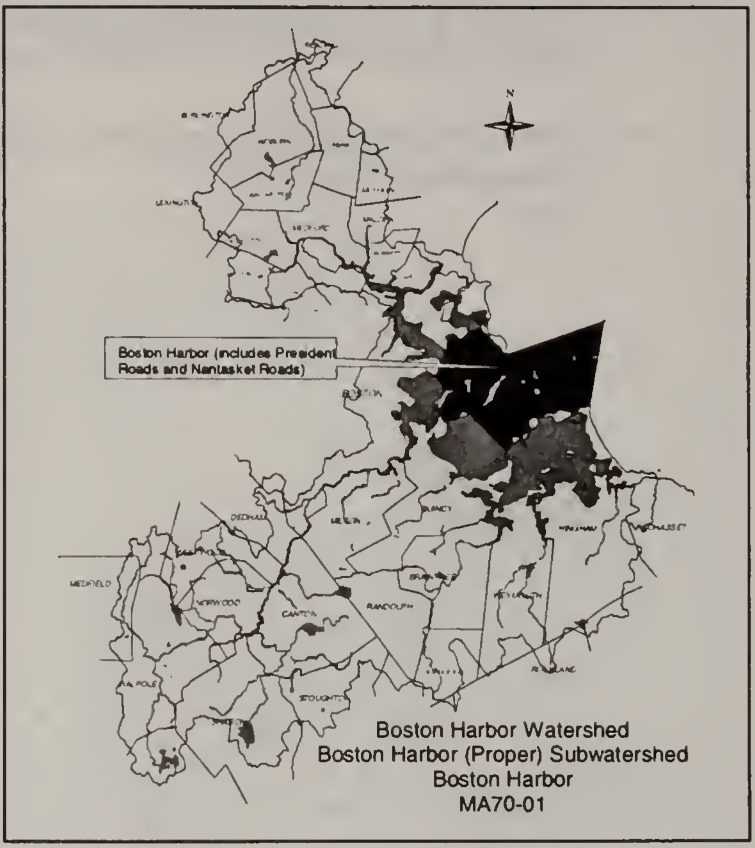
Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		NOT ASSESSED				
Fish Consumption		NOT ASSESSED				
Shellfishing		PARTIAL SUPPORT 0.25 mi^2 NON-SUPPORT 2.05 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		NOT ASSESSED				
Secondary Contact		NOT ASSESSED				
Aesthetics		NOT ASSESSED				

RECOMMENDATIONS HULL BAY (MA70-09)

- Conduct a bacterial/pathogenic source differentiation study to determine the source of bacteria causing the closure of the shellfish growing areas.

- Track progress of municipal storm water management plans and implementation of best management practices.

BOSTON HARBOR (SEGMENT MA70-01)


N
Boston Harbor (includes President Roads and Nantasket Roads)

Boston Harbor Watershed
Boston Harbor (Proper) Subwatershed
Boston Harbor
MA70-01

Location: The area extending into Massachusetts Bay from the line between Fort Dawes on Deer Island to The Graves, and from The Graves south to Point Allerton; across Hull and West guts; across the mouths of Quincy and Dorchester bays, Boston Inner Harbor and Winthrop Bay (including President Roads and Nantasket Roads).
Segment Area: 23 square miles.
Classification: Class SB Shellfishing (R)

This segment is on the 1998 303(d) list of impaired waters for pathogens (MA DEP 1999a).

The Coastal Lobster Investigations Project of DMF conducts an annual coastwide commercial lobster sea sampling program which provides biological and catch/effort data from six coastal regions during the major lobstering season, May-November (20-year time series to date). This is a cooperative effort with the lobster industry conducted aboard commercial lobster vessels. A second annual sampling effort for early benthic phase/juvenile lobsters is conducted using Self Contained Underwater Breathing Apparatus (SCUBA) through suction sampling in order to generate density indices of newly settled post-larval lobsters (6-year time series to date) and delineate coastal habitat important to the settlement of these juveniles. Year-round bottom temperature monitoring (13-year time series to date) is conducted with programmable electronic recorders at various depths at seven coastal sites, north and south of Cape Cod. These are replaced annually by SCUBA diving. Additional sites will be added during 2001 (Estrella 2001).

In mid-summer 1998, the wastewater previously treated at the MWRA Nut Island facility was transferred via a deep-rock tunnel, to the Deer Island facility. This transfer, known as 'inter-island transfer', ended more than 50 years of discharges of primary treated wastewater to the South Harbor, and increased flows of secondary treated wastewater to the outer North Harbor.

In a *Comparison of Water Quality in Boston Harbor Before and After Inter-island Transfer* MWRA compared data collected from 14 sampling stations in Boston Harbor (north harbor and south harbor) before and after the inter-island transfer. In each region, sampling was conducted at two sets of stations: 'outfall stations' - in the immediate vicinity of the outfalls of the two treatment facilities and 'receiving-water stations' - located further afield, away from the outfalls. The report focused on three water quality issues: symptoms of eutrophication of the Boston Harbor water column (nutrient concentrations, standing stocks of phytoplankton, and dissolved oxygen), water clarity and concentrations of solids in the water column, and counts of sewage indicator bacteria in the water column (Taylor 2001).

WMA WATER WITHDRAWAL:

There are no regulated water withdrawals from Boston Harbor.

SURFACE NPDES DISCHARGE SUMMARY:

MWRA (MA0102351) was permitted to discharge from POTW outfalls to this segment of Boston Harbor.

001- Deer Island Treatment Plant Outfall #1, continuous discharge
002- Deer Island Treatment Plant Outfall #2, continuous discharge
003- Deer Island Treatment Plant Relief #1, continuous discharge for flow rates above 400 MGD
004- Deer Island Treatment Plant Relief #2, continuous discharge for flow rates above 500 MGD
005- Deer Island Treatment Plant Relief #3, continuous discharge for flow rates above 600 MGD

As part of their whole effluent toxicity tests, MWRA analyzed their effluent for TRC on 85 occasions between March 1996 and July 2000. Concentrations ranged from BDL to 3.4 mg/L (TOXTD). The permit was issued in December 1986 and remained effective until the new Deer Island Treatment Plant permit (MA0103284) was issued in May of 1999 Permit MA0102351 was rescinded.

Massachusetts Water Resources Authority Deer Island WWTP (MA0103284) is now permitted (issued 1999, modified May 2000) to discharge 436 MGD treated wastewater to Massachusetts Bay via outfall T01. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$. The facility's TRC limit is 631 μg/L (maximum daily). The new Deer Island outfall (T01) begins with a deep rock tunnel extending under Massachusetts Bay to a point about 9.5 miles east of Deer Island. The tunnel is 24 feet in diameter and can convey a flow from the plant of up to 1.27 billion gallons a day. The actual discharge of treated effluent is through a diffuser, which consists of more than fifty pipes that rise to the seabed over the last 6,600 feet of the tunnel's length. The purpose of the diffuser is to assure that the maximum dispersion and dilution is achieved for the wastewater flow. Outfall T01 became operational in September 2000.

MWRA Nut Island Headworks (MA0103268) is permitted to discharge storm water via outfalls 001 and 002 to Quincy Bay and Boston Harbor and temporary site dewatering discharge via outfalls 011, 012, and 013 to Hingham and Quincy bays. This permit expired 14 December 1997. This facility no longer discharges.

Sithe-New Boston Station (MA0004731) has two condenser cooling water discharges (258 and 232 MGD) to the Boston Harbor proper. The permit contains a 96 °F temperature limit with a $\leq$ 25 °F temperature change. The permit expired on 15 January 1999. The permit is expected to be reissued in 2003.

Hull WWTP (MA0101231) is permitted to discharge 3.07 MGD of treated wastewater to this segment of Boston Harbor (at Stony Beach) via outfall 001. The facility's permit limit for whole effluent toxicity is $LC_{50} \geq 100\%$. Secondary limits include BOD and TSS concentrations of 30 mg/L and a fecal coliform bacteria limit of 200 colonies/100mL. TRC concentrations, in the effluent, between February 1996 and February 2001 ranged from BDL to 0.200 mg/L (TOXTD), below the permit limit of 1.0 mg/L. This permit is currently (December 2001) up for reissuance.

Long Island Hospital WWTP (MA0102377) was closed and ceased to discharge in 2001.

All communities in the Boston Harbor Watershed (excluding Boston) are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

USE ASSESSMENT

AQUATIC LIFE

Biology

As part of the MWRA 2000 fish and shellfish monitoring program, winter flounder *(Pseudopleuronectes americanus)* and lobster *(Homarus americanus)* samples were collected from Deer Island Flats. Caged blue mussels *(Mytilus edulis)*, from Rockport were also deployed at Deer Island Flats to evaluate bioaccumulation potential (Lefkovitz *et al.* 2001).

The external condition of winter flounder indicated few abnormalities. Mean concentrations of organic compounds in winter flounder fillets (PCB, DDT chlordane, Mirex) and liver tissue (PCBs, chlorinated pesticides, PAHs) were generally higher at Deer Island Flats than at MWRA's other sampling locations. The flounder edible tissue contaminant levels, (wet weight), like those detected in previous monitoring years (1992-1999), were well below the federal action limits and the 1992-1999 MWRA Appreciable Change Levels (Lefkovitz *et al.* 2001).

No deleterious external conditions were noted in lobsters. Mean concentrations of organic compounds in edible tail meat tissue and the hepatopancreas were generally highest at Deer Island Flats than at MWRA's other sampling locations. Concentrations of total PCB in lobster hepatopancreas continued to show an upward trend in 2000 at Deer Island Flats. The 2000 levels, like other monitoring years, were well below the federal action limits for pesticides, PCBs and mercury and indicate no risk for human consumption (Lefkovitz *et al.* 2001).

Mussel survival within the deployed arrays from Deer Island, Boston Inner Harbor, upon recovery was high (96%). The 2000 data were similar to previous years with the highest body burdens of contaminants observed in mussels deployed in Boston Inner Harbor. The 2000 levels (total PCBs, pesticides, total PAHs, mercury, and lead), like other monitoring years, were well below the federal action limits and indicate no risk for human consumption (Lefkovitz *et al.* 2001).

Toxicity

Effluent

MWRA Nut Island (MA0102351) conducted 27 whole effluent toxicity tests on outfall 101 using the mysid shrimp, *M. bahia* between March 1996 and June 1998. In twenty-three of the *M. bahia* acute toxicity tests the LC_{50} was $\leq$ 100% effluent. Additionally, between April 1997 and June 1998, MWRA conducted 15 whole effluent toxicity tests using the sheepshead minnow, *Cyprinodon variegatus.* In three *C. variegatus* acute toxicity tests (20%) the LC_{50} was $\geq$ 100% effluent. It should be noted that this discharge was eliminated when MWRA moved their discharge to Massachusetts Bay.

MWRA Deer Island WWTP (MA0102351) conducted monthly whole effluent toxicity tests on outfall 001 using *M. bahia* between March 1996 and July 2000. The facility did not meet its LC_{50} limit of $\geq$ 50% effluent in 11 of the 51 *M. bahia* tests. Since December 1997 (n=30), the facility only violated their acute toxicity permit limit twice. Additionally, between April 1997 and July 2000, monthly whole effluent toxicity tests were conducted using *C. variegatus.* Only one of the 38 *C. variegatus* tests violated the permit limit of 50% effluent. This discharge has also been eliminated by the deep ocean outfall that discharges to Massachusetts Bay.

Between February 1996 and February 1997, Hull WWTP conducted four whole effluent toxicity tests using the mysid shrimp *M. bahia*. The *M. bahia* LC_{50}'s ranged between 82% and 88% effluent. Additionally, between February 1996 and February 2001, Hull WWTP conducted 16 whole effluent toxicity tests using the inland silverside, *M. beryllina. M. beryllina* LC_{50}'s ranged between 82 -100% with no violations of the permit limits since 1997.

Ambient

Hull WWTP collects water from Stony Beach in Boston Harbor for use as their dilution water in their whole effluent toxicity tests. Between February 1996 and February 1997, survival (48-hour) of *M. bahia* was not less than 90% and *M. beryllina* survival exposed (48 hr) to the Harbor water was good (not less than 88%).

Chemistry – water

Hull WWTP collects water from Boston Harbor for use as dilution water in their whole effluent toxicity tests. Water quality parameters (pH, TSS, and ammonia-nitrogen) from the 16 sampling events are summarized below.

As part of their ongoing receiving water monitoring program, MWRA collected monthly water quality samples (DO, temperature, turbidity, Chlorophyll *a,* and TSS) at 11 sites on this segment of Boston Harbor (Coughlin 2001a):

044, mouth of Dorchester Bay, day marker #5; 1996-2000
048, Quincy Bay, off Moon Island Outfall; 1996-200
050, Outer harbor, Calf Island; 1996-2000
065, Inner Harbor, President Roads, R Buoy #2; 1996-2000
075, Inner Harbor, Fort Point Channel at Broadway; 1996 and 1997
106, Outer Harbor, Long Island, green can #17; 1996 -2000
116, Hingham Bay, Mouth of Fore River, Red Nun#28; 1998 and 1999
118, Outer Harbor, Lovell Island, Red Nun #8; 1996-2000
129, Deer Island Flats (between Deer Island and airport); 1997-2000
135, Boston North Channel, Red #10 Fl Red Bell; 1996-2000
141, Quincy Bay/ Outer Harbor, Peddocks Island; 1996-2000

DO

MWRA DO concentrations ranged from 2.4 – 12.99 mg/L; n=2,357. Dissolved oxygen concentrations were below 5.0 mg/L in the surface waters on 18 occasions (station 075S; 1996-1997) and in the bottom waters on two occasions (station 065B; 1998). Additionally, percent saturations were below 75% on 69 occasions and were above 115% on 135 occasions (range 25.5-144.8%; n=2,361).

pH

pH in Boston Harbor as reported in the Hull WWTP toxicity testing reports ranged between 7.09 and 7.9 SU (n=16).

Temperature

MWRA temperature readings (n=2,502) were below the SWQS for a class SB waterbody.

Turbidity

Turbidity levels recorded by MWRA ranged from 0.4 to 1,000 NTU with an average of 8.39 NTU (n=1,239).

Chlorophyll a

Chlorophyll *a* measurements were collected on 708 occasions by MWRA. Bottom concentrations ranged from 0.16 to 20.7 µg/L and surface concentration ranged from 0.206 to 28.3 µg/L.

Total Suspended Solids

Suspended solids concentrations as reported in the Hull WWTP toxicity testing reports ranged between 32 and 132 mg/L (n=16). However, MWRA TSS concentrations, recorded on 692 occasions, ranged from 0.43 to 16.1 mg/L.

Ammonia-Nitrogen (as N)

Concentrations of ammonia reported in the Hull WWTP toxicity testing reports ranged between BDL and 1.420 mg/L (n=16).

The *Aquatic Life Use* is assessed as support based on water chemistry data within the SWQS for a Class SB waterbody (high spatial and temporal coverage), the biological data (fish and shellfish) and good ambient survival data.

FISH CONSUMPTION

In 1998, MDPH issued an advisory concerning consumption of seafood from Boston Harbor, including Quincy Bay (Celona 2001):

> "Lobster tomalley—all persons should eliminate consumption of the lobster tomalley (liver). This recommendation applies to tomalley from lobsters from any source due to the finding of abnormally high chemical contaminant levels…
>
> Boston Harbor Fishery Products—Pregnant and breast –feeding women, women who intend to become pregnant, children under the age of 12, and individuals with lowered immunity should avoid consuming certain fishery products from Boston Harbor. This applies to lobster, flounder, soft-shell clams and other bivalves…"

The *Fish Consumption Use* is assessed as non-support for this entire segment due to the MDPH seafood fish consumption advisory for Boston Harbor.

SHELLFISHING

The DMF Shellfish Status Report of October 2000 indicates that shellfish growing area GBH5.3 is conditionally restricted, shellfish growing area MB13.0 is closed seasonally for management, and shellfish growing areas GBH2.0, GBH3.0, GBH3.1, GBH4.0, GBH5.0, GBH5.6, GBH6.0, MB13.0, and N28.0 are prohibited (DFWELE 2000b).

Based on the DMF Shellfish Status Report the *Shellfishing Use* is assessed as partial support for 0.15 mi^2 and non-support for 18.22 mi^2 of this segment of Boston Harbor. Due to the management closure, 4.63 mi^2 are not assessed.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

As part of their ongoing receiving water monitoring program, MWRA collected fecal coliform bacteria samples at seven of their water quality stations (050, 065, 106, 118, 129, 135, and 141) on this segment of Boston Harbor (Coughlin 2001a). Of the 1,853 samples collected, only eight were greater than 400 cfu/100mL (range <5 to 2,960 cfu/100mL). The sample with the highest count was collected during wet weather conditions. Additionally, MWRA recorded Secchi disk depths at nine water quality stations (044, 048, 050, 065, 106, 118, 129, 135, and 141) on this segment of Boston Harbor (Coughlin 2001a). Secchi disk depths ranged from 0.7-13 m. Of the 1,282 readings recorded, 25 were less than SWQS of 1.2 m and on nine occasions the Secchi disk was seen all the way to the bottom.

The MWRA also collected fecal coliform bacteria samples at MDC38 Lovells Island (between August 1996 and August 1997). Of the 14 samples collected, the highest fecal coliform bacteria count was 12 cfu/100 mL (Coughlin2001b).

Based on the low fecal coliform bacteria counts (only isolated instances of SWQS exceedances) and good water clarity, the *Primary* and *Secondary Contact Recreational* uses are assessed as support for this segment of Boston Harbor.

AESTHETICS

MWRAs turbidity and TSS samples and Secchi disk depths indicated relatively low turbidity with good water clarity (Coughlin 2001a). However, more than 130 barrels of small debris, 300 pieces of large debris, and 30 pieces of piers and other oversized debris were collected between July 1, 2000 and September 15, 2000 during the pilot year of the Boston Harbor Marine Debris Salvage Program. Debris was collected from "high activity areas" such as the downtown waterfront, the Charlestown Navy Yard, the East Boston waterfront, South Boston waterfront, the Outer Fort Point Channel, and Chelsea Creek. Additionally, more than 57 tons were collected in 2001 (East Boston 2001).

Since the trash and debris collected by the Marine Debris Salvage program was associated with storm water runoff, and therefore, localized, it is best professional judgment that the *Aesthetics Use* is assessed as support for Boston Harbor. Boston Harbor is, however, on "Alert Status" due to this large volume of trash and debris.

Boston Harbor (MA70-01) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		SUPPORT				
Fish Consumption		NON-SUPPORT	Priority organics		Unknown	
Shellfishing		PARTIAL SUPPORT 0.15 mi^2 NON-SUPPORT 18.22 mi^2 NOT ASSESSED 4.63 mi^2 For watershed-wide shellfish growing area data see Appendix E.				
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics*		SUPPORT*				

* "Alert Status" issues identified—See *Aesthetics Use* Assessment

RECOMMENDATIONS BOSTON HARBOR (MA70-01)

- Conduct a bacterial/pathogenic source differentiation study to determine the source of bacteria causing the closure of the shellfish growing areas.

- Review results of the MWRA's *Final 1998 CSO Sediment Synthesis Report.*

LITERATURE CITED

Ackerman, M.T. 1989 April. *Compilation of Lakes, Ponds, Reservoirs* and *Impoundments Relative to the Massachusetts Lake Classification Program.* Publication: #15901-171-50-4-89-c.r. Technical Services Branch, Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering, Westborough, MA.

ACOE. 1998. *Use Attainability Study of the East Branch Neponset River Canton, Stoughton, and Sharon, Massachusetts.* U.S. Army Corps of Engineers, New England District. Waltham, MA.

ACOE. 30 April 2001. *Update Report for Massachusetts.* [Online]. U.S. Army Corps of Engineers, New England District. http://www.nae.usace.army.mil. 4 January 2002.

ACOE. 31 October 2001. *Update Report for Massachusetts.* [Online]. U.S. Army Corps of Engineers, New England District . http://www.nae.usace.army.mil. 4 January 2002.

ACOE. 2001. *Annual Water Quality Report Fiscal Year 2000.* U.S. Army Corps of Engineers, New England District. Waltham, MA.

AMRA. 1997. *Comprehensive Report of the Lower Mystic Watershed: Shoreline Survey Results and Analysis for Mystic River, Alewife Brook, Malden River.* Alewife/Mystic River Advocates. Somerville, MA.

Beaulieu, K. 2001. (kmbeauli@usgs.gov) *Fish community and Benthic Invertebrate Protocol and Datasets for Aberjona and Neponset rivers.* United States Geologic Survey, New England Coastal Basins National Water Quality Assessment Program, East Hartford, CT. E-mails to Katie O'Brien, MA DEP dated 22 and 26 October 2001.

Berasi, B. and L. Harrahy. 2001. *Benthic Macroinvertebrate Phase of BUDGETS.* Neponset River Watershed Association. Canton, MA.

Big Dig. 2000. *The Central Artery Tunnel; The Big Dig Worth Its Wait* [Online] http://www.bigdig.com/ Massachusetts Turnpike Authority, Boston, MA. 4 March 2002.

Boston Harbor Islands. 2002. [Online] http://www.bostonislands.org/manage/manage_park_overview.html 16 September 2002.

Brady, P. 2001. (Phillips.Brady@state.ma.us) *Charles River Watershed Information.* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries. Pocasset, MA. Email to Katie O'Brien, MA DEP dated 18 July 2001.

Brander, K. 2001a. (Kevin.Brander@state.ma.us). *MWRA CSOs.* Department of Environmental Protection, Northeast Regional Office, Wilmington. E-mail to Katie O'Brien (katie.obrien@state.ma.us) at Massachusetts Department of Environmental Protection dated 12 December 2001.

Brander, K. 2001b. (Kevin.Brander@state.ma.us). *Additional MWRA CSO Information.* Department of Environmental Protection, Northeast Regional Office, Wilmington. E-mail to Katie O'Brien (katie.obrien@state.ma.us) at Massachusetts Department of Environmental Protection dated 21 March 2002.

Brander, K. 2002. (Kevin.Brander@state.ma.us). *Updates to SWQS with relation to CSO Designations.* Department of Environmental Protection, Northeast Regional Office, Wilmington. E-mail to Katie O'Brien (katie.obrien@state.ma.us) at Massachusetts Department of Environmental Protection dated 21 March 2002.

Campo, K. 2002. (Kcampo@usgs.gov) *USGS Volatile Organic Compound Monitoring in the Aberjona River.* United States Geologic Survey, New England Coastal Basins National Water Quality Assessment Program, Northborough, MA. Email to Jim Blair, MA DEP dated 27 February 2002.

Celona, M. 2001. (Mike.Celona@state.ma.us). *Saltwater Fish Consumption Advisories.* Communication with Massachusetts Department of Public Health. MA. Facsimile to Katie O'Brien, MA DEP dated 18 July 2001.

Chalmers, A. T. 2001. (chalmers@usgs.gov). *Toxics Substances Hydrology Program Sampling in Boston Harbor.* Hydrologist (sediments) USGS, Montpelier, VT. E-mail to Katie O'Brien, MA DEP dated 17 October 2001.

Chase, B. 1990. *Massachusetts Division of Marine Fisheries Massachusetts Bay Smelt Spawning Habitat Monitoring Program Progress Report for 1988 and 1989 on the Weymouth-Fore River.* Massachusetts Division of Marine Fisheries, Salem, MA.

Chase, B. 1996. *Massachusetts Bay Smelt Spawning Habitat Monitoring Program – Preliminary Report on the Neponset River.* Massachusetts Division of Marine Fisheries. Salem, MA.

Chase, B. 2000. *Massachusetts Bay Smelt Spawning Habitat Monitoring Program – Rainbow Smelt Spawning Habitat in Furnace Brook, Quincy.* Massachusetts Division of Marine Fisheries. Salem, MA.

Chesebrough, E. 2002. Personal Communication. *Title 5 Program- Comprehensive Community Septic Management Program Participants in the Boston Harbor Watershed.* Massachusetts Department of Environmental Protection, Worcester, MA.

Chretien, R. 2002. (Richard.Chretien@state.ma.us) *Sanitary Sewer Overflows in the Weymouth and Weir Subwatershed.* Email to Mollie Weinstein, MA DEP 13 February 2002.

City of Boston. 2000. *Urban Wilds Initiative.* [Online] http://www.cityofboston.com/parks/urbanwilds.asp City of Boston, Massachusetts. 1 March 2002.

Cooke, I and S. Lipman. 2002. (cooke@neponset.org and Steven.Lipman@state.ma.us) Loss *of water from the Boston Harbor Watershed through Inflow and Infiltration.* Emails to Katie O'Brien, MA DEP dated 7-8 March 2002.

Coughlin, K. 2001a. (Kelly.Coughlin@mwra.state.ma.us). *Beach data from MDC/MWRA.* Massachusetts Water Resource Authority, ENQUAD. Boston, MA. Email to Katie O'Brien, MA DEP dated 18 July 2001.

Coughlin, K. 2001b. (Kelly.Coughlin@mwra.state.ma.us). *MWRA Boston Harbor Water Quality Data and MWRA Monitoring Stations map 1995-2000.* Massachusetts Water Resource Authority, ENQUAD. Boston, MA. Email to Katie O'Brien, MA DEP dated 18 July 2001.

Coughlin, K. 2002. (Kelly.Coughlin@mwra.state.ma.us). *MWRA Monitoring Data for Mystic, Neponset, and Weymouth and Weir subwatersheds* Massachusetts Water Resource Authority, ENQUAD. Boston, MA. Email to Mollie Weinstein, MA DEP dated 25 February 2002.

Coughlin, K. and A. Stanley. 2001. Draft Water Quality at Four Boston Harbor Beaches: Results of Intensive Monitoring, 1996-1999. Massachusetts Water Resources Authority, Environmental Quality Division, Boston, MA.

CZM. 3 October 2001. Pumpout Facilities in the Boston Harbor Region. [Online]. Massachusetts Office of Coastal Zone Management. http://state.ma.us/czm/pobh.htm. 21 December 2001.

Dallaire, T.D. 2000. *NPDES toxicity testing discharge monitoring report summary.* Toxicity Testing Database (TOXTD). Dbase Application. Massachusetts Department of Environmental Protection, Division of Watershed Management, Watershed Planning and Permitting Program, Database Manager. Worcester, MA.

DFWELE. 28 July 1999. *Adopt a Stream Neponset River Watershed.* [Online] http://www.state.ma.us/dfwele/River/rivbasin.htm. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Riverways Program. 17 December 2001.

DFWELE. 2000a. *Alewife Brook/ Little River Shoreline Survey and Action Plan.* Department of Fisheries Wildlife and Environmental Law Enforcement, Riverways Program. Alewife Brook/ Little River Stream Team. Friends of the Alewife Reservation. Cambridge, MA.

DFWELE. 2000b. *Designated Shellfish Growing Areas Datalayer – October 2000.* Published by MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs, Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries, Boston, MA.

DFWELE. 2001a. *Stormwater Monitoring Program – Water Quality Monitoring Data November 1999 – November 2000.* Alewife/Mystic River Advocates in collaboration with City of Somerville Department of Public Works and MA DFWELE Urban Rivers Program. Somerville MA.

DFWELE. 2001b. *Traphole Brook Project.* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Riverways Program.

DFEWLE. 15 March 2001. *Massachusetts Trout Stocked Waters - 2001* [Online] http://www.state.ma.us/dfwele/dfw/dfwsttrt.htm Department of Fisheries Wildlife and Environmental Law Enforcement 26 April 2001.

East Boston. 21 August 2000. *Massport Contributes to Cleaner Harbor.* [Online] http://www.eastboston.com/PublicDocs/massport000818.htm East Boston Online, CB Publishing & Consulting, Inc., East Boston, MA. 5 March 2002.

Environmental Law Reporter. 1988. *Clean Water Deskbook.* Environmental Law Institute. Washington, D.C.

EOEA. 2000. *Massachusetts Watershed Initiative Annual Report July 2000.* Executive Office of Environmental Affairs. Boston, MA.

EPA. 1997. *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Report Contents.* United States Environmental Protection Agency, Assessment and Watershed Protection Division (4503f). Office of Wetlands, Oceans and Watersheds. Office of Water. Washington, D.C.

EPA 20 July 2000. *EPA's BEACH Watch Program: Release of 1999 Swimming Season Data.* [Online] (http://www.epa.gov/ost/beaches/2000fact.html). United States Environmental Protection Agency. 1 March 2002.

EPA. 2001a. *EPA New England National Priorities List (NPL) Fact Sheet: INDUSTRI-PLEX EPA ID #: MAD076580950.* United States Environmental Protection Agency, New England Record Center. Boston, MA. Fact Sheet Release Date: 05/09/2001.

EPA. 2001b. *EPA New England National Priorities List (NPL) Fact Sheet: Wells G&H EPA ID #: MAD980732168.* United States Environmental Protection Agency, New England Record Center. Boston, MA. Fact Sheet Release Date: 10/26/2001.

EPA. 2001c. *EPA Awards $363,257 Grant to Somerville for Mystic River Project.* Press Release #01-12-01. [Online] http://www.epa.gov/region01/pr/2001/dec/011201.html EPA New England. Boston, MA.12/3/2001.

EPA. 5 November 2001 *1999 UEI Boston Goals.* [Online]. United States Environmental Protection Agency New England, Urban Environmental Initiative. http://www.epa.gov/region01/eco/uei/boston/bgoals99.html. 4 January 2002.

Estrella, B. 2001. (bruce.estrella@state.ma.us) *American Lobster sampling activities.* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries, Pocasset, MA. Email to Katie O'Brien, MA DEP dated 17 July 2001.

Franklin. A. 2001. Personal communication. *Fore River Watershed Association: bacteria and herring run data/information.* Community Outreach Coordinator, Fore River Watershed Association. Quincy, MA.

Frymire, R. 2000. *A snapshot of the Alewife Watershed: Observations and bacterial sampling results from Fall, 1999.* Prepared for Mystic River Watershed Association. Cambridge, MA.

Fugro East Inc. 1996. *Summary Report on the Restoration of Hills Pond in Menotomy Rocks Park, Arlington Massachusetts.* Prepared for the Town of Arlington. Fugro East, Inc. Northborough MA.

Galvin, M. 2002. Personal Communication. *Town Brook Diversion Tunnel.* Massachusetts District Commission. Boston, MA.

Gallagher, E. D. and K. K. Keay. 1998. *Organism-sediment-contaminant interactions in Boston Harbor.* [Online] *http://www.es.umb.edu/edg/bhms/bh2ms.htm*

Godfrey, Paul J., Mark D. Mattson, Marie-Françoise Walk, Peter A. Kerr, O. Thomas Zajicek, and Armand Ruby III, 1996. *The Massachusetts Acid Rain Monitoring Project: Ten Years of Monitoring Massachusetts Lakes and Streams with Volunteers.* [Online] http://www.umass.edu/tei/wrrc/arm.html University of Massachusetts Water Resource Center, Amherst, MA.

Halliwell, D.B., W.A. Kimball and A.J. Screpetis. 1982. *Massachusetts Stream Classification Program Part I: Inventory of Rivers and Streams.* Massachusetts Division of Fisheries and Wildlife, Department of Fisheries, Wildlife, and Recreational Vehicles and Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering. Westborough, MA.

Hargreaves Associates. 5 Feb 2002. {Online} *Condor Street Urban Wild Now in Design.* http://www.hargreaves.com/news/design/condor.html 19 February 2002.

Hogan, P.H. 2001. Personal Communication. Bo*ston Harbor: NPDES permitting information.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA

Ivushkina, T. 1999. *Toxic Elements in the Sediments of the Alewife Brook and Mill Brook Watersheds: Spatial distribution and Depositional History.* Tufts University, Cambridge, MA.

Jean, H. 2002. (Hillary.Jean@state.ma.us) *Water Withdrawal* From *the Farm River, Great Pond, and Richardi Reservoir.* Massachusetts Department of Environmental Protection, Northeast Regional Office, Bureau of Resource Protection, Wilmington, MA. Email to Katie O'Brien, MA DEP dated 17 April 2002.

Kennedy, L, L. O'Shea, W.J. Dunn, Jr, and D. LeVangie. 1995. *The Neponset River Watershed 1994 Resource Assessment Report.* Massachusetts Department Of Environmental Protection, Office of Watershed Management, North Grafton and Boston, MA

Kropp, RK, R.J. Diaz, D.T. Dahlen, J.D. Boyle, and C.D. Hunt. 2000. 1999 Harbor Benthic Monitoring Report. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2001-03. 94 p. plus appendices.

Laramie, R. 2002. Personal communication with P. Mitchell. *Status of Craddock Locks, Mystic River Subwatershed.* Camp Dresser & McKee.

Lefkovitz, L, S. Abramson, R. Hillman, J. Field, and M. Moore. 2001. *2000 Annual Fish and Shellfish Report.* Boston: Massachusetts Water Resources Authority. Report ENQUAD 2000-20. p. 143.

LeVangie, D. 2001. *Water withdrawal registration and permit information.* Water Management Act Database. Massachusetts Department of Environmental Protection, Division of Watershed Management, Database Manager. Boston, MA.

Ludlam, S.D. and B. Duval. 2001. *Natural and Management-Induced Volume and Stability in a Coastal, Meromictic Lake.* Journal of Lake and Reservoir Management 17(2): 71-81, 2001

MA DEM. 1993. *Areas of Critical Environmental Concern (ACEC) Program Guide June 1993.* Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Department of Environmental Management, ACEC Program. Boston, MA.

MA DEM. August 2000. *Areas of Critical Environmental Concern Listing and Index.* [Online] http://www.state.ma.us/dem/programs/acec/acec1.htm Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Department of Environmental Management, ACEC Program. Boston, MA.

MA DEP. 1996. (Revision of 1995 report). *Massachusetts surface water quality standards.* Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA 114p. (Revision of 314 CMR 4.00, effective June 23, 1996.)

MA DEP. 13 November 1998. Baird & McGuire Superfund Site [Online] (http://www.state.ma.us/dep/bwsc/baird/main.htm#a2) Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, Boston, MA. 20 March 2002.

MA DEP. 1999a. *Final Massachusetts Section 303(d) List of Waters 1998.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999b. *Baseline Lake Survey Quality Assurance Project Plan dated 14 July 1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 1999c. *Draft Quality Assurance Project Plan (CN13.0) Fish Contaminant Monitoring Program 1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 1999d. *Quality Assurance Project Plan (CN7.0) For 1999 Benthic Macroinvertebrate Biomonitoring.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 1999e. Open file. *DWM 1999 Lake TMDL field sheets.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 2000a. *Commonwealth of Massachusetts Summary of Water Quality 2000.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 2000b. Open files. *License applications for herbicide treatment: 1996 through 2000.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 22 Feb 2000. Energy Facilities Fore River Station Project Overview. [Online] http://www.state.ma.us/dep/energy/fore/feirfr1.htm Massachusetts Department of Environmental Protection. 1 March 2002.

MA DEP. 3 July 2000. *Posavina Oil Tanker Chelsea Creek - #6 Fuel Oil Spill.* [Online] Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup. 4 January 2002.

MA DEP. 2001a. *Quality Management Plan for Federally Funded Programs.* Revision number 2001-01. Massachusetts Department of Environmental Protection. Boston, MA.

MA DEP. 2001b. Open File. *PALIS updates.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 2001c. *Open NPDES permit files.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 2001d. *Draft Total Maximum Daily Loads of Bacteria for Neponset River Basin.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Maietta, R.J. 2001. Personal communication. *Interpretation of USGS Fish Population Assemblages in the Neponset and Aberjona Rivers.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MassPort. 2002. *Boston's Logan International Airport, About Logan.* [Online]. http://www.massport.com/logan/about.asp Massachusetts Port Authority. Boston, MA ©1999-2001.

MassGIS. 2000. *Hydrography - statewide 1:25,000.* MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs, Boston, MA.

MassWildlife. 2001. Draft Aril 2000 *Coldwater Fisheries Resources List.* Massachusetts Department of Fisheries Wildlife and Environmental Law Enforcement, Division of Fisheries and Wildlife (MassWildlife), Westborough, MA.

Mattson, M.D., P.J. Godfrey, R.A. Barletta and A. Aiello, 1998. *Eutrophication and Aquatic Plant Management in Massachusetts Draft Generic Environmental Impact Report.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA and Massachusetts Department of Environmental Management, Boston, MA. 435pp.

Mattson, M. 2002. Personal Communication. *Boston Harbor Watershed Lake TMDL Status.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Mayor, A. 2001. (Anna.Mayor@state.ma.us) Industri-Plex Superfund Site Sampling. Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, Boston, MA. Email to Katie O'Brien, MA DEP dated 26 July 2001.

MDC. 2002. *The Metropolitan District Commission Division of Watershed Management.* [Online]. http://www.state.ma.us/mdc/water.htm Metropolitan District Commission. Boston, MA. 22 February 2002.

MDPH. 1994. *Public Health Interim Freshwater Fish Consumption Advisory.* Massachusetts Department of Public Health, Boston, MA.

MDPH. 2001a. *Freshwater Fish Consumption Advisory List.* Massachusetts Department of Public Health, Bureau of Environmental Health Assessment. Boston, MA.

MDPH. 2001b. *Public Health* Statewide *Fish Consumption Advisory issued July 2001.* The Commonwealth of Massachusetts, Bureau of Environmental Health Assessment, Boston, MA.

MDPH. 2002. *105 CMR 445.000: Minimum Standards For Bathing Beaches, State Sanitary Code, Chapter VII.* Massachusetts Department of Public Health, Division of Community Sanitation Regulations and Statues {Online} http://www.state.ma.us/dph/dcs/csanregs.htm. 19 September 2002.

Menzie-Cura & Associates, Inc. 2001. *Working Draft Environmental Risk Characterization Neponset Reservoir Foxborough, Massachusetts RTN#4-11387 Tier 1A Permit #138020.* Menzie-Cura & Associates, Inc., Chelmsford, MA.

MyRWA. Undated. Mystic River Watershed Association. [Online]. Mystic River Watershed Association http://www.tufts.edu/mystic/intro.html. 17 December 2001.

MyRWA 2001. *Water Quality in the Mystic River Watershed: A Study of 10 Site (July-December 2000) DEP Project Number 00-07/MWI Boston Harbor Hydrologic and Water Quality Investigations Mystic Results.* Mystic River Watershed Association, Arlington, MA.

MWRA. 13 December 2001. *How the Deer Island Sewage Treatment Plant Works.* [Online]. Massachusetts Water Resource Authority. http://www.mwra.state.ma.us/sewer/html/sewditp.htm. 6 April 2001

MWRA. 2002. *Massachusetts Water Resource Authority, The Water System.* [Online] http://www.mwra.state.ma.us/water/html/wat.htm. Massachusetts Water Resource Authority, Boston, MA. 22 February 2002.

NepRWA. Undated. *What is NepRWA?* [Online]. Neponset River Watershed Association. http://www.neponset.org/abneprwa.html. 17 December 2001.

NepRWA. 1998. Citizen Water Monitoring Network 1997 Final report Neponset River Watershed Association. Canton, MA.

NepRWA. 1999. Neponset River Watershed Association Citizen Water Monitoring Network 1998 Sampling Season Final Report. Neponset River Watershed Association. Canton, MA.

NepRWA. 2001a. Personal Communication. 1999 CWMN data. Neponset River Watershed Association. Canton, MA.

NepRWA. 2001b. *CWMN (swim'min) Citizen Water Monitoring Network 2000-2001 Sampling Season Final Report.* DEP Project 00-07-MWI: Boston Harbor Hydrologic and Water Quality Investigation: Neponset Results. Neponset River Watershed Association. Canton, MA.

NepRWA. 2002. Personal Communication. *Comments on the 1999 Boston Harbor Watershed Water Quality Assessment Report.* Neponset River Watershed Association. Canton, MA.

O'Keefe, K. 2002. Personal Communication. *Boston Harbor WMA Registration and Permitting Information and 1999 Average Annual Withdrawal Volumes.* Massachusetts Department of Environmental Protection, Northeast Regional Office, Wilmington, MA.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the protection* and *management of aquatic sediment quality in Ontario.* Water Resources Branch, Ontario Ministry of the Environment. Ontario, Canada.

Perez, G. 2002. Personal communication. Mystic River Watershed Association, Chelsea, MA.

Roberson, S. 2002. (Stephen.Roberson@state.ma.us). Eastern Fuel Coal Tar Processing Facility Information. Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, Wilmington, Massachusetts. Email to Katie O'Brien MA DEP dated 13 February 2002.

Richards, T. 2001. (Todd.Richards@state.ma.us) *Traphole and Hawes Brook Fish Population Data.* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries. Westborough, MA. Email to Katie O'Brien, MA DEP dated 3 December 2001.

Rojko, A. M., W. A. Kimball, and A. J. Screpetis. 1995. *Designated Outstanding Resource Waters of Massachusetts 1995.* Massachusetts Executive Office of Environmental Affairs, Department of Environmental Protection, Bureau of Resource Protection, Office of Watershed Management. Grafton, MA.

Ryan, S. 2001. (Scott.Ryan@state.ma.us) Massachusetts Department of Environmental Management, Office of Dam Safety, Devens, MA. Email to Susan Connors, MA DEP dated July 3, 2001.

Save the Harbor/Save the Bay. Undated. *Campaign for the Water's Edge: The Condor Street Urban Wild on Chelsea Creek, Chelsea, MA*. [Online] Save the Harbor/Save the Bay. http://www.savetheharbor.org/cwhat1.html 4 January 2002.

Scarlet, G. 2002. Personal Communication. *Boston Harbor Watershed: Storm Water Permitting Information.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Socolow, R.S., C.R. Leighton, J.L. Zanca, and L.R. Rambsey. 1998. *Water Resources Data for Massachusetts* and *Rhode Island, Water Year 1997.* U.S. Geological Survey Report MA-RI-97-1. Water Resources Division, Northboro, MA.

Socolow, R.S., L. Y. Comeau, J.L. Zanca, and L.R. Rambsey. 1999. *Water Resources Data for Massachusetts* and *Rhode Island, Water Year 1998.* U.S. Geological Survey Report MA-RI-98-1. Water Resources Division, Northboro, MA.

Socolow, R.S., J.L. Zanca, D. Murino Jr., and L.R. Ramsbey. 2000. *Water Resources Data for Massachusetts* and *Rhode Island, Water Year 1999.* U.S. Geological Survey Report MA-RI-99-1. Water Resources Division, Northboro, MA.

Socolow, R.S., J.S. Whitley, D. Murino, Jr., and L.R. Ramsbey. 2001. *Water Resources Data for Massachusetts* and *Rhode Island, Water Year 2000.* U.S. Geological Survey Report MA-RI-00-1. Water Resources Division, Northborough, MA.

Smith, G. 2000. *Letter to Mr. Alan McClennon, Department of Planning & Community Development, Town of Arlington*, dated 6 January 2000. Aquatic Control Technologies, Inc. Sutton, MA.

Storrs, Lee. 2002. Personal Communication to Peter Mitchell. Camp Dresser & McKee.

Taylor, D. 2001. *Comparison of water quality in Boston Harbor before and after inter-island transfer.* Boston, Massachusetts Water Resources Authority. Report ENQUAD 2001-09.

UMass Amherst. 1999. *Land Use Datalayer - statewide 1:25,000.* Published by MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs for the Resource Mapping Project at the University of Massachusetts Amherst, MA.

USGS. 5 June 2001. [Online]. Massachusetts and Rhode Island A*ugust 1999 Drought Statement.* United States Geological Survey. http://ma.water.usgs.gov/current_cond/august_1999_statement.htm. 5 September 2001.

USGS. 13 June 2001. *Surface-Water Monitoring Activities—Updated August 2000.* [Online] United States Geological Survey. http://nh.water.usgs.gov/CurrentProjects/nawqa/pdf/sw_web.pdf, 8/18/00.

Woods, S. 2001. (minibarn@mediaone.net) *Weir River Water Quality Sampling/ Shoreline Surveys.* Weir River Watershed Association, Hingham MA. E-mail to K. O'Brien, MA DEP, dated 16 August 2001.

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PREFACE:

The objective of DWM's data validation process is to ensure that the quality of monitoring data meets defined criteria for acceptability as "final", usable data. This is accomplished by thoroughly reviewing and evaluating all draft data and associated field and laboratory quality control information. This report includes evaluation of all 1999 data, as well as 1994 fish toxics data, collected in the Boston Harbor watershed.

The 1999 Data Validation Report (MADEP 2000a) summarizing 1999 DWM monitoring QA/QC results is also available as a separate evaluation of all 1999 DWM data.

This Appendix is divided into seven sections as follows:

- A1. Introduction
- A2. Data Validation Process for 1999 DWM Data
- A3. 1999 QAPPs/SOPs Used in Boston Harbor Watershed Monitoring
- A4. 1999 QA/QC Acceptance Criteria for Boston Harbor Watershed Data
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- A7. Conclusions

A1. INTRODUCTION

The following data were collected in 1999 as part of the DEP/DWM Boston Harbor Watershed assessment:

- Discrete water quality data and Hydrolab® readings at seven lakes and one tributary inlet,
- Benthic macroinvertebrates and aquatic habitat assessment at a total of fourteen stream stations,
- Fish tissue toxics at two lake locations (Upper and Lower Mystic Lakes), and
- Fish population assessment at nine stream sites

For specific monitoring locations, parameters, and dates, see Table B1 in Appendix B.

A2. THE DATA VALIDATION PROCESS FOR 1999 DWM DATA

The procedures used to accept, accept with qualification or censor data were based on the draft DWM Standard Operating Procedure (SOP) for data validation (MADEP 2002). These procedures are supplemental to separate data quality assurance activities and laboratory validation performed by the analytical laboratory, Wall Experiment Station (WES).

The data validation SOP outlines specific criteria by which to evaluate data quality and acceptability. These criteria pertain to the following elements:

- Conformance to DWM-project and DWM-programmatic Quality Assurance Project Plans (QAPPs) and Standard Operating Procedures (SOPs)

- Precision (review of overall precision, including field precision and lab precision)

- Accuracy (review of lab quality control data regarding analysis of blind performance evaluation samples, internal check standards, blanks and matrix spike samples)

- Representativeness (review of field data sheets and field SOPs used to collect the data for the evidence of the potential for non-representative conditions at the time of sampling)

- Holding Times and Preservation (review for conformance to method holding times and preservation requirements for samples)

- Frequency of Field QC samples (review for conformance to standard DWM requirements for the number of field blank and split/duplicate samples taken per total number of samples taken)

- Contamination of Field Blanks (review of blank analyses for detectable analyte concentrations)

- Completeness (review of the amount of usable data in comparison to that intended to be collected)

- Chain-of-Custody (review of sample handling and transfer records)

Data that fell outside QA/QC acceptance criteria were investigated and may have been subject to censoring or qualification. Specific symbols and qualifiers used to censor and qualify data are provided in Table A1.

Completion of 1999 data validation for the Boston Harbor Watershed data resulted in the entry of the "final" data into the DWM water quality database, and its use for assessment purposes.

Table A1. 1999 Data Symbols and Qualifiers

Symbol/ Qualifier	Data Source	Definition
**	All	Censored or missing data
--	All	No data
<mdl	All	Less than method detection limit (MDL). Denotes a sample result that went undetected using a specific analytical method. The actual, numeric MDL is typically specified (eg. <0.2).
c	Hydrolab®	Greater than calibration range for conductivity (>718, 1413, 2760, 6668 or 12,900 uS/cm) or turbidity (> 10, 20 or 40 NTUs), depending on calibration standard used, or outside acceptable range about calibration standard. Also used for calculated TDS and Salinity readings that are based on qualified conductivity readings.
i	Hydrolab®	inaccurate readings from Hydrolab® multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, or lack of calibration of the depth sensor prior to use.
m	Hydrolab®	method not followed; one or more protocols contained in the DWM Hydrolab® SOP not followed, i.e., operator error (e.g., less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.
s	Hydrolab®	Field sheet recorded data were used to accept data, not data electronically recorded in the Hydrolab® surveyor unit, due to operator error or equipment failure.
u	Hydrolab®	unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc.
?	Hydrolab®	Light interference on Turbidity sensor (Hydrolab® error message). Data is typically censored.
a	Discrete samples	accuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP.
b	Discrete samples	blank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
d	Discrete samples	Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP.
f	Discrete samples	frequency of quality control duplicates did not meet data quality objectives identified for program or in QAPP.
h	Discrete samples	holding time violation (usually indicating possible bias low)
j	Discrete samples	'estimated' value; used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used by WES to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< *x* <rdl).
m	Discrete samples	method SOP not followed or fully implemented, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), or additional steps taken by the lab to deal with matrix complications.
p	Discrete samples	Samples not preserved per SOP or analytical method requirements.
r	Discrete samples	Samples collected not representative of actual field conditions.

A3. 1999 QAPPS/SOPS USED IN BOSTON HARBOR WATERSHED MONITORING

Quality assurance and quality control (QA/QC) planning/process documents in place and activities performed before, during and/or after 1999 Boston Harbor Watershed monitoring included:

- Production of a draft 1999 Quality Assurance Project Plan (QAPP) for fish contaminant monitoring (MA DEP. 1999c; now CN 13.0)
- Production of a 1999 QAPP for benthic macroinvertebrate collection (MA DEP 1999e; CN 7.0)
- Production of a 1999 QAPP for Lakes Baseline TMDL assessments (MA DEP 1999a; CN 22.0)
- Production of a draft SOP for apparent color determination (MA DEP 1999g; now CN 2.0)
- Production of a draft SOP for chlorophyll *a* collection (MA DEP 1999h; now CN 3.0)
- Production of an SOP for grab sample collection (MA DEP 1999b; CN 1.0). This included the use of bucket samplers (this technique has been discontinued).
- Implementation of field and lab quality control standard operating procedures, including that for Hydrolab® multiprobe use (MA DEP 1999d; CN 4.0) and fish collection/preparation for fish tissue analysis (MA DEP 1999f; now CN 40.0)
- On-going coordination with the WES laboratory regarding sample delivery, analysis and reporting
- Post-monitoring data review and validation
- Production of a draft 1999-2000 QAPP for DEP/CERO SMART monitoring (MA DEP 2000b; now CN 12.0). The objectives, procedures and site-specific information contained in this draft QAPP were used in 1999.

The majority of analytical methods used by WES in 1999 were based on those contained in Standard Methods (Clesceri et al. 1998).

A4. 1999 QA/QC ACCEPTANCE CRITERIA FOR BOSTON HARBOR WATERSHED DATA

A4.1 QA/QC Objectives and Criteria for 1999 *In-Situ* Hydrolab® Multiprobe Data

Trained DWM staff members conducted *in-situ* measurements using a Hydrolab® Series 3 Multiprobe instrument that simultaneously measures dissolved oxygen, temperature, pH, conductivity, and depth, and provides calculated estimates for total dissolved solids/salinity, and % saturation of oxygen.

To ensure the quality of the Boston Harbor data, the following QA/QC steps were taken:

- Pre- Survey Calibration and Check: Standard pre-survey calibration of the Hydrolab® unit was conducted in accordance with the DWM SOP for Hydrolab use. After the instrument was calibrated and before the instrument was released to field staff, an instrument check using both a low ionic standard and filtered de-ionized water was performed. The purpose of this check is to make sure that the instrument is providing stable readings as the waters in Massachusetts are typically of low ionic strength. If the instrument failed acceptance criteria, it was not released to field staff until the source of error was identified and corrected.

- Post Survey Check: A standard post survey check of the Hydrolab® unit was performed in accordance with the DWM SOP for Hydrolab® use. Upon return of the Hydrolab® unit to DWM's lab after a survey run, a visual inspection was performed to identify any physical damage that may have occurred in the field. The calibration of the unit was then checked against both a low ionic standard and filtered deionized water. The results of the post survey calibration check were compared to the pre-calibration results. If visual damage was observed and/or post calibration acceptance criteria were not achieved, the source of error was investigated and data collected in the field may have been subject to qualification or censoring.

- Data Reduction: The Hydrolab® Coordinator and Database Manager reviewed the Hydrolab® data for instability, instrument malfunction, operator error and aberrant trends. If any of these conditions were detected, the data were further investigated and may have been recommended for qualification or censoring. Measured data are specifically evaluated for the following:

- Consistency with the Hydrolab® SOP (specifically, the requirement for three (minimum)-five (preferred) sequential readings one-minute-apart at appropriate depths, proper field use, etc.).

- Accuracy and precision of readings, as assessed through review of pre-survey calibration/check and post-survey check data, as well as field notes for any information on faulty operation and/or unusual field conditions.

- Representativeness of data (review of field sheets and notes for any information that might indicate non-representativeness; e.g. not taken at the deep hole).

- Check for "outliers" or unreasonable data, based on best professional judgment. Outliers are identified and flagged for scrutiny. For lake depth profiles, it is recognized that thermal stratification can cause rapid changes in Hydrolab® parameters within the thermocline, often resulting in unstable readings (typically qualified with "u").

- In lieu of verifying in the electronic record that the Hydrolab® was depth-calibrated prior to use, both general and specific criteria are used to accept, qualify or censor of Hydrolab® Depth readings, as follows: General Depth Criteria: Apply to each OWMID#; For negative and zero depth readings: Censor (i), (likely in error); for 0.1 m depth readings: Qualify (i), (potentially in error); and for 0.2 and greater depth readings: Accept without qualification, (likely accurate). Specific Depth Criteria: Apply to entirety of depth data for survey date. If zero and/or negative depth readings occur more than once per survey date, censor all negative/zero depth data, and qualify all other depth data for that survey (indicates that erroneous depth readings were not recognized in the field and that corrective action (field calibration of the depth sensor) was not taken, i.e., that all positive readings may be in error.).

- The criterion used for 1998-99 data to accept, qualify or censor Conductivity (and the dependent, calculated estimates for TDS and Salinity) readings was based on exceedance of the calibration standard concentration. For exceedances greater than two times the standard, the conductivity reading was typically censored. Readings were qualified for exceedances less than two times the calibration standard. Note: In cases where readings fell far below the calibration standard concentration (e.g. measured value of 100 uS/cm using 6668 calibration standard), no censoring or qualification was imposed. Turbidity data with respect to the calibration standard concentration was evaluated on a case-by-case basis without any set criteria.

- For D.O. values less than 0.2 mg/l, 1999 data were accepted without qualification and reported as "<0.2". Similarly, percent DO saturation was reported as "<2%" when DO values were <0.2 mg/l.

- Total dissolved solids (TDS) values were calculated from conductivity readings using a multiplier of 0.64. Percent oxygen saturation values were calculated by comparing ambient D.O. readings to saturation values.

A4.2 QA/QC Objectives and Criteria for 1999 Discrete Water Sample Data

The collection and analysis of discrete water samples from the Boston Harbor watershed followed the DWM Standard Operating Procedure for grab sampling (CN# 1.0) and analyte-specific WES SOPs. Using the following criteria, as well as other considerations and input from data reviewers, individual datum were accepted, accepted with qualification or censored. In cases where poor quality control (e.g. blank/cross contamination) affected batched analyses or entire surveys, censoring/qualification decisions were applied to groups of samples (e.g. a specific crew's samples, a specific survey's samples or all samples from a specific batch analysis).

- Sampling/Analysis Holding Time: Each analyte has a standard holding time that has been established to ensure sample/analysis integrity. Refer to DWM Standard Operating Procedure CN# 1.1 for a complete listing. If the standard holding time was exceeded, this criterion is violated and the data may be censored, depending on the extent of exceedance. For very minor exceedances (e.g. < than 10% of the holding time), the data is typically qualified ("H" for minor holding time violation).

- Quality Control Sample Frequency: At a minimum, one field blank and one replicate must be collected for every ten samples by any given sampling crew on any given date. If less than 10% blanks and/or replicates were collected, the data may be censored or qualified, based on a review of crew member experience, training and history, as well as other factors relevant to the specific survey.

- Field Blanks: Field blanks were prepared at the DWM Worcester Laboratory. Reagent grade water was transported into the field in a sample container where it was transferred into a different sample container and fixed where necessary using the same method as its corresponding field sample. All blanks were submitted to the WES laboratory "blind". If the field blank results were greater than the MDL, the data may be censored or qualified, depending on extent and other factors.

- Field Replicates: In 1999, field replicate samples were taken as "split" samples, where two independent samples were created from a larger volume sample (not sequential duplicates or co-located duplicates). Both samples were submitted to WES laboratory "blind". In order for this data quality criterion to be met, the results must generally be:
    - <20% Relative Percent Difference (RPD) for method detection limits >1mg/L, or
    - <30% RPD for method detection limits <1mg/L.

or meet more specific criteria contained in a 1999 QAPP. If the criteria are not met, the data may be censored or qualified, depending on extent of exceedance and other factors. In most cases, poor precision of field split samples reflects potential poor reproducibility for entire surveys and/or analytical batch runs, and may lead to the censoring/qualification of same.

- Laboratory assessment of analytical precision and accuracy**:** The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. WES staff release discrete water sample data when their established QA/QC criteria have been met. When the following criteria cannot be met, data are qualified as "estimated" (using a "J" value) if appropriate, or no data ("ND") is reported:

    - Low Calibration Standards – Checks the stability of the instrument's calibration curve; analyzes the *accuracy* of an instrument's calibration within a 5% range.

    - Reference Standards – Generally, a second source standard (a standard different from the calibration stock standard) that analyzes the method *accuracy*.

    - Laboratory Reagent Blank/Method Blank (LRB) – Reagent grade water (de-ionized) extracted with every sample set used to ensure that the system is free of target analytes (< MDL) and to assess potential blank contamination.

    - Duplicate Sample – Measures the *precision* (as Relative Percent Difference or RPD) of the analytical process. The acceptable laboratory %RPD range is typically ≤ 25%.

    - Spike Sample (Laboratory Fortified Blank - LFB, Laboratory Fortified Matrix - LFM) – Measures the *accuracy* (% Recovery) of an analytical method. The acceptable laboratory % recovery range is typically between 80 – 120% for LFB samples and 70 –130% for LFM discrete water samples.

- Range of Logs (bacteria data) – Acceptance limits established by WES for range of log-transformed duplicate data.

A4.3 QA/QC Objectives and Criteria for 1999 (and 1994) Fish Tissue Contaminant Data

Fish collected (and prepared for analysis) from the Boston Harbor Watershed in 1994 and 1999 followed procedures contained in the DWM 1999 Standard Operating Procedure (SOP) for fish contaminant monitoring (now CN 40.0). This SOP adheres to EPA-approved laboratory QA/QC methodologies (EPA 823-R-95-007). Laboratory data quality was assessed at WES by analyzing the following quality control samples:

- Laboratory Reagent Blank/Method Blank (LRB) – Clean clam tissue matrix extracted with every sample set to ensure that the system is free of target analytes (< MDL) and to assess the potential for blank contamination.

- Laboratory Fortified Blank (LFB) – Clean clam tissue matrix spiked with a low concentration of target compounds. LFB results are used to establish *accuracy* of system's performance. The acceptable laboratory % recovery range is typically 80 – 120%.

- Laboratory Fortified Matrix (LFM) – Tissue matrix spiked with a low concentration of a target compound. LFM and LFM duplicate results are used to establish *accuracy* of the extraction and analytical process. The acceptable laboratory % recovery range is typically between 70 – 130% for metal analysis and 60 –140% for PCB/Organochlorine Pesticide analysis.

- Quality Control Standard (QCS) – A pre-spiked secondary tissue sample. QCS results are used to establish *accuracy* in the extraction and test methods. The acceptable laboratory % recovery range is typically between 80–120%.

- Laboratory sample duplicates – A second lab sample is taken the blended fish tissue slurry for analysis of all analytes. Used to estimate analytical precision, the acceptable laboratory relative percent difference (RPD) for lab duplicates is typically 80-120%.

A4.4 QA/QC Objectives of 1999 Data for Benthic Macroinvertebrates, Aquatic Habitat and Miscellaneous Biological Monitoring (periphyton, aquatic macrophytes, phytoplankton, etc.)

Macroinvertebrate sampling and processing was conducted by DWM biologists, as described in the SOP *Water Quality Monitoring In Streams Using Aquatic Macroinvertebrates* (now 39.0), which is based on US EPA Rapid Bioassessment Protocols (RBP III). The QAPP for 1999 biomonitoring outlined general QC steps that included:

- Thorough rinsing of sampling equipment between stations to prevent inter-station cross-contamination.
- Duplication and checking (for transcription errors) of documentation and database entries.
- In-house spot-checking (among two DWM biologists) of taxa identifications for accuracy.

A4.5 QA/QC Objectives and Criteria for Use of 1999 Data from External Sources

In performing assessment of individual segments in the Boston Harbor watershed, DWM used information and data from the following external sources in this report (discussed in detail in the "Sources of Information" section of the main report).

- Federal agencies (USGS, ACOE and USEPA)
- Municipal POTWs
- Municipal and industrial NPDES permitees
- State agencies (MWRA, MDPH, DFWELE, DMF and DEM)
- Local agencies and non-profit groups (Boston Harbor Association), and

- Volunteer monitoring groups and citizens (Neponset River Watershed Association, Mystic River Watershed Association, Weir River Watershed Association, Fore River Watershed Association, Alewife/Mystic River Advocates, Friends of the Mystic River, Alewife Brook Stream Team, misc. individuals)

In general, the pre-requisites for use of these sources are: 1) a QAPP was prepared (and followed), 2) a State-certified laboratory was used, 3) documentation was prepared for data management QA/QC, and 4) a citable report was produced. Some data, however, are used that do not meet all of these criteria (with appropriate text qualification).

No specific criteria were used in evaluating the data quality from these sources. The level of quality control review for individual data sources was variable, and due to staff resource limitations, most information was accepted at “face value”, with appropriate context given to potentially suspect data (e.g. lacking any QC documentation).

A5. QC SAMPLE DATA AND VALIDATION DECISIONS FOR 1999 (AND 1994 FISH TOXICS) BOSTON HARBOR WATERSHED DATA

Data validation procedures, as now outlined in DWM’s draft Data Validation SOP (draft, 2001; CN 56.0) were applied to in-situ Hydrolab®, discrete water quality and fish tissue data (1994 and 1999) for the Boston Harbor watershed (see Table A2). The 1999 Data Validation Report (MADEP 2000a) summarizing 1999 DWM monitoring QA/QC results is also available as a separate evaluation of all 1999 data.

Assessment and validation of the benthic macroinvertebrate, periphyton and habitat data collected for the Boston Harbor drainage area is not covered here. DWM QA/QC assessment of benthic/habitat data is typically more general in nature (i.e., adherence to the SOP and QAPP, discussions with primary staff on QAPP implementation, etc.).

Table A2. 1999 Boston Harbor Censored/Qualified Hydrolab® Data

Waterbody	**Survey Date(s)**	OWMID#	Censored/ Qualified Hydrolab® Parameters	**Censored/ Qualified**	**Reason and/or Clarification**
Turners Pond	7/27/99	LB-0046	PH at 2.5 m depth	Qualify (u)	Unstable readings
Winter Pond	8/10/99	LB-0159	D.O. and %SAT at 0.5 m	Qualify (u)	Unstable readings
Winter Pond	8/10/99	LB-0161	Temp and pH at 0.5 m PH at 1.0 m	Qualify (u) Qualify (u)	Unstable readings
Cobbs Pond	8/12/99	LB-0180	D.O. and % SAT at 0.5, 1.2 and 1.5 m	Qualify (i)(u)	Unstable readings (potential stirrer malfunction)
Turners Pond	8/24/99	LB-0194	Temp at 4.4 m	Qualify (u)	Unstable readings
Lower Mystic Lake	8/24/99	LB-0199	D.O., % SAT, temp, cond and pH at 4.5 m Temp at 5.5 m Cond. At 12 and 14 m All readings at 15 m, and all readings at 15.9 m, except conductivity Conductivity at 15.9m	Qualify (u) Qualify (u) Qualify (c) Qualify (m) (c) **Censor (m) (c)**	Unstable readings Unstable readings > calibration range (718) Only 1 reading (intentional to protect D.O. probe) Only one reading and very high cond. close to bottom
Cobbs Pond	9/13/99	LB-0336	Temp at 0.5 m D.O. and % SAT at 0.5 and 1.5 m	Qualify (u) Qualify (u)	Unstable readings
Lower Mystic Lake	8/5/99	LB-0422	Temp at 4.0 m D.O. and % SAT at 3.3 m All parameters at 15.7 m	Qualify (u) Qualify (u) Qualify (m)	Unstable readings Only 1 reading at bottom
Lower Mystic Lake	8/5/99	LB-0423	Temp, D.O. and % SAT at 0.5 m and 4.0 m All parameters at 16.1 m, except conductivity Conductivity at 16.1m	Qualify (u) Qualify (m) (c) **Censor (m) (c)**	Unstable readings Only 1 reading at bottom (intentional) Cond. >>> calibration range, 718
Lower Mystic Lake	8/24/99	LB-0429	Temp at 5.5 m All parameters at 10.0 m All parameters at 15.5 m	Qualify (u) Qualify (m) Qualify (m)	Unstable readings Very short equilibration time for 3 readings (67 sec.) Only 1 reading at bottom (intentional)
Lower Mystic Lake	9/21/99	LB-0448	D.O. and % SAT at 7.0 m Conductivity At 10, 11, 11.9 and 13.4 m	Qualify (u) Qualify (c)	Unstable readings > calibration range (718)
Lower Mystic Lake	9/21/99	LB-0504	D.O. and % SAT at 7.0 m Conductivity At 9, 10, 11, 13.5 Conductivity at 16.0 m	Qualify (u) Qualify (c) **Censor (c)**	Unstable readings > calibration range (718) >>> calibration range (718)

A5.2 Discrete Sample Data Validation

A5.2.1 Quality Control Sample Results

Field blank and field replicate sampling results for all discrete water quality sample data taken in 1999 are provided in Table A3 and Table A4. Quality control sample data are stored and maintained in the *Water Quality Data (WQD)* Access Database.

*Note: **All 1999 lake QC samples are listed for quality control review purposes.** For multiple-lake surveys, certain lakes may not have had any QC samples (taken at another lake for same day survey). The relevant survey dates for Boston Harbor lake sampling are 7/15, 7/27, 8/5, 8/10, 8/12, 8/24, 9/7, 9/13 and 9/21.*

Table A3. 1999 DEP DWM inlake physico-chemical QA/QC field blank data. (All units expressed in mg/L unless otherwise specified.)

Date	OWMID	OWMID QA/QC	Alkalinity (mg/L)	Color (PCU)	Total Phosphorus (mg/L)
Field Blank Sample					
08/03/99	LB-0078	BLANK	<2.0	<15	<0.005
09/29/99	LB-0229	BLANK	--	--	<0.005
08/05/99	LB-0105	BLANK	<2.0	<15	<0.005
09/28/99	LB-0405	BLANK	<2.0	<15	<0.005
08/31/99	LB-0380	BLANK	<2.0	<15	<0.005
09/29/99	LB-0234	BLANK	<2.0	--	--
07/29/99	LB-0053	BLANK	<1.0	<15	<0.005
08/25/99	LB-0203	BLANK	<2.0	<15	<0.005
09/23/99	LB-0354	BLANK	<2.0	<15	<0.005
08/04/99	LB-0096	BLANK	<2.0	<15	<0.005
09/01/99	LB-0241	BLANK	<2.0	<15	<0.005
10/05/99	LB-0390	BLANK	<2.0	<15	<0.005
09/02/99	LB-0256	BLANK	<2.0	<15	<0.005
07/28/99	LB-0065	BLANK	<1.0	<15	<0.005
08/26/99	LB-0216	BLANK	<2.0	<15	<0.005
09/22/99	LB-0365	BLANK	<2.0	<15	<0.005
08/05/99	LB-0415	BLANK	<2.0	<15	<0.005
08/12/99	LB-0187	BLANK	--	--	<0.005
07/15/99	LB-0029	BLANK	<2.0	<15	<0.005
08/12/99	LB-0183	BLANK	--	--	<0.005
09/13/99	LB-0329	BLANK	<2.0	<15	<0.005
07/27/99	LB-0041	BLANK	<1.0	<15	<0.005
08/24/99	LB-0191	BLANK	<2.0	<15	<0.005
09/21/99	LB-0341	BLANK	<2.0	<15	<0.005
07/14/99	LB-0023	BLANK	<2.0	<15	<0.005
08/11/99	LB-0171	BLANK	<1.0	<15	<0.005
09/09/99	LB-0316	BLANK	<2.0	--	<0.005
07/13/99	LB-0003	BLANK	2.0	**	<0.005
08/10/99	LB-0153	BLANK	<1.0	<15	<0.005
09/07/99	LB-0304	BLANK	<2.0	--	<0.005
09/13/99	LB-0281	BLANK	<2.0	<15	<0.005
08/11/99	LB-0120	BLANK	--	--	<0.005
09/15/99	LB-0267	BLANK	<2.0	--	<0.005

" ** " = Censored or missing data " -- " = No data
" **<mdl** " = Less than method detection limit (MDL). Denotes a sample result that went undetected using a specific analytical method. The actual, numeric MDL is typically specified (e.g. <0.2).

Table A4. 1999 DEP DWM inlake physico-chemical QA/QC field replicate data. (All units expressed in mg/L unless otherwise specified.)

Date	OWMID	OWMID QA/QC	Alkalinity (mg/L)	Color (PCU)	Total Phosphorus (mg/L)
Mill Road Pond (Palis: 41032)					
Station: A	Description: deep hole, near dam at eastern end of pond, Brimfield.				
8/3/1999	LB-0076	LB-0077	18	55	0.023
8/3/1999	LB-0077	LB-0076	20	60	0.020
Relative Percent Difference (RPD):			*10.5%*	*8.7%*	*14.0%*
9/29/1999	LB-0226	LB-0227	13	--	0.025
9/29/1999	LB-0227	LB-0226	11	--	0.026
Relative Percent Difference (RPD):			*16.7%*		*3.9%*
Morse Pond (Palis: 41033)					
Station: A	Description: deep hole near outlet at southern end, Southbridge.				
8/5/1999	LB-0103	LB-0104	15	50	0.12
8/5/1999	LB-0104	LB-0103	15	46	0.14
Relative Percent Difference (RPD):			*0.0%*	*8.3%*	*15.4%*
9/28/1999	LB-0403	LB-0404	9.0	41	0.017
9/28/1999	LB-0404	LB-0403	9.0	44	0.018
Relative Percent Difference (RPD):			*0.0%*	*7.1%*	*5.7%*
Sherman Pond (Palis: 41046)					
Station: A	Description: deep hole in northeast quadrant of pond, Brimfield.				
8/31/1999	LB-0378	LB-0379	**m	38	0.022
8/31/1999	LB-0379	LB-0378	12	29	0.021
Relative Percent Difference (RPD):				*26.9%*	*4.7%*
Sibley Pond (Palis: 41047)					
Station: A	Description: North Basin, deep hole at southern end, Charlton.				
7/29/1999	LB-0051	LB-0052	25**d**	17**d**	0.030
7/29/1999	LB-0052	LB-0051	15**d**	31**d**	0.030
Relative Percent Difference (RPD):			*50.0%*	*58.3%*	*0.0%*
8/25/1999	LB-0201	LB-0202	20	44**d**	0.050
8/25/1999	LB-0202	LB-0201	19	25**d**	0.048
Relative Percent Difference (RPD):			*5.1%*	*55.1%*	*4.1%*
Sibley Pond (Palis: 41048)					
Station: A	Description: South Basin, deep hole close to center of pond, Charlton.				
9/23/1999	LB-0353	LB-0352	19	75	0.084
9/23/1999	LB-0352	LB-0353	18	70	0.088
Relative Percent Difference (RPD):			*5.4%*	*6.9%*	*4.7%*
Pierpont Meadow Pond (Palis: 42043)					
Station: A	Description: deep hole south of Charlton/Dudley border, Dudley.				
8/4/1999	LB-0094	LB-0095	12	17	**d
8/4/1999	LB-0095	LB-0094	10	17	**d
Relative Percent Difference (RPD):			*18.2%*	*0.0%*	
9/1/1999	LB-0238	LB-0239	11	29	0.022
9/1/1999	LB-0239	LB-0238	12	29	0.019
Relative Percent Difference (RPD):			*8.7%*	*0.0%*	*14.6%*
10/5/1999	LB-0388	LB-0389	11	23	0.027**d**
10/5/1999	LB-0389	LB-0388	11	22	0.016**d**
Relative Percent Difference (RPD):			*0.0%*	*4.4%*	*51.2%*
Rochdale Pond (Palis: 42048)					
Station: A	Description: deep hole in southeastern quadrant near outlet, Leicester.				
9/2/1999	LB-0254	LB-0255	14	46	0.028
9/2/1999	LB-0255	LB-0254	13	--	0.028
Relative Percent Difference (RPD):			*7.4%*		*0.0%*

** = censored data; -- = no data (no sample collected);
QUALIFIERS: **d** = precision of field **d**uplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected; **m** = **m**ethod SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, and lost/unanalyzed samples.

Table A4. Continued. 1999 DEP DWM inlake physico-chemical QA/QC field replicate data. (All units expressed in mg/L unless otherwise specified.)

Date	OWMID	OWMID QA/QC	Alkalinity (mg/L)	Color (PCU)	Total Phosphorus (mg/L)
Wallis Pond (Palis: 42062)					
Station: A	Description: deep hole, southern central lobe near dam, Dudley.				
7/28/1999	LB-0063	LB-0064	20	46**d**	0.021
7/28/1999	LB-0064	LB-0063	21	60**d**	0.022
Relative Percent Difference (RPD):			*4.9%*	*26.4%*	*4.7%*
8/26/1999	LB-0214	LB-0215	30	43	0.028
8/26/1999	LB-0215	LB-0214	31	31	0.028
Relative Percent Difference (RPD):			*3.3%*	*32.4%*	*0.0%*
9/22/1999	LB-0363	LB-0364	12	49	0.025
9/22/1999	LB-0364	LB-0363	14	60	0.025
Relative Percent Difference (RPD):			*15.4%*	*20.2%*	*0.0%*
Lower Mystic Lake (Palis: 71027)					
Station: B	Description: northwest quadrant of pond, Arlington/Medford.				
8/5/1999	LB-0416	LB-0417	54	<15	**d
8/5/1999	LB-0417	LB-0416	56	--	**d
Relative Percent Difference (RPD):			*3.6%*		
Ganawatte Farm Pond (Palis: 73037)					
Station: A	Description: deep hole, northern lobe of pond, Walpole				
7/15/1999	LB-0027	LB-0028	12	230**d**	0.030**d**
7/15/1999	LB-0028	LB-0027	13	120**d**	0.041**d**
Relative Percent Difference (RPD):			*8.0%*	*62.9%*	*31.0%*
8/12/1999	LB-0181	LB-0182	12	120**d**	****m**
8/12/1999	LB-0182	LB-0181	14	70**d**	****m**
Relative Percent Difference (RPD):			*15.4%*	*52.6%*	
9/13/1999	LB-0327	LB-0328	12	110**d**	0.034
9/13/1999	LB-0328	LB-0327	12	70**d**	0.035
Relative Percent Difference (RPD):			*0.0%*	*44.4%*	*2.9%*
Turners Pond (Palis: 73059)					
Station: A	Description: deep hole in southeastern quadrant, Milton.				
7/27/1999	LB-0039	LB-0040	20	44	0.054
7/27/1999	LB-0040	LB-0039	21	40	0.053
Relative Percent Difference (RPD):			*4.9%*	*9.5%*	*1.9%*
8/24/1999	LB-0189	LB-0190	23	<15**d**	0.038
8/24/1999	LB-0190	LB-0189	22	26**d**	0.037
Relative Percent Difference (RPD):			*4.4%*	*53.7%*	*2.7%*
9/21/1999	LB-0339	LB-0340	19	29	0.048
9/21/1999	LB-0340	LB-0339	18	31	0.048
Relative Percent Difference (RPD):			*5.4%*	*6.7%*	*0.0%*
Flint Pond (Palis: 84012)					
Station: A	Description: deep hole, center of eastern lobe, Tyngsborough.				
7/14/1999	LB-0020	LB-0022	28	50	0.025
7/14/1999	LB-0022	LB-0020	25	65	0.025
Relative Percent Difference (RPD):			*11.3%*	*26.1%*	*0.0%*
8/11/1999	LB-0169	LB-0170	33	28**d**	0.021
8/11/1999	LB-0170	LB-0169	35	35**d**	0.021
Relative Percent Difference (RPD):			*5.9%*	*22.2%*	*0.0%*
9/9/1999	LB-0314	LB-0315	36	--	0.017
9/9/1999	LB-0315	LB-0314	37	--	0.016
Relative Percent Difference (RPD):			*2.7%*		*6.1%*

** = censored data; -- = no data (no sample collected); QUALIFIERS: **d** = precision of field **d**uplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected; **m** = **m**ethod SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, and lost/unanalyzed samples.

Table A4. Continued. 1999 DEP DWM inlake physico-chemical QA/QC field replicate data. (All units expressed in mg/L unless otherwise specified.)

Date	OWMID	OWMID QA/QC	Alkalinity (mg/L)	Color (PCU)	Total Phosphorus (mg/L)
Newfield Pond (Palis: 84046)					
Station: A	Description: deep hole in southeastern quadrant near outlet, Chelmsford.				
7/13/1999	LB-0001	LB-0002	26	<15m	0.022
7/13/1999	LB-0002	LB-0001	26	17m	0.022
Relative Percent Difference (RPD):			*0.0%*	*12.5%*	*0.0%*
8/10/1999	LB-0151	LB-0152	26	23	0.024
8/10/1999	LB-0152	LB-0151	27	23	0.024
Relative Percent Difference (RPD):			*3.8%*	*0.0%*	*0.0%*
9/7/1999	LB-0302	LB-0303	27	--	0.020
9/7/1999	LB-0303	LB-0302	29	--	0.018
Relative Percent Difference (RPD):			*7.1%*		*10.5%*
Ryder Pond (Palis: 96268)					
Station: A	Description: deep hole in northwest quadrant of pond, Truro.				
9/13/1999	LB-0279	LB-0280	<2.0	<15	0.008
9/13/1999	LB-0280	LB-0279	<2.0	<15	0.008
Relative Percent Difference (RPD):			*0.0%*	*0.0%*	*0.0%*
Walkers Pond (Palis: 96331)					
Station: A	Description: deep hole, mid pond, Brewster.				
8/11/1999	LB-0118	LB-0119	--	--	0.074
8/11/1999	LB-0119	LB-0118	--	--	0.074
Relative Percent Difference (RPD):					*0.0%*
9/15/1999	LB-0265	LB-0266	6.0	--	0.054
9/15/1999	LB-0266	LB-0265	8.0	--	0.054
Relative Percent Difference (RPD):			*28.6%*		*0.0%*

** = censored data; -- = no data (no sample collected);

QUALIFIERS: **d** = precision of field **d**uplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected; **m** = **m**ethod SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, and lost/unanalyzed samples.

A5.2.2 Censored/Qualified 1999 Boston Harbor Discrete Water Sample Data

Data censored, qualified or accepted without qualification are summarized in Table A5 below. All other data were accepted.

Table A5. 1999 DEP DWM Censored/Qualified Boston Harbor Data.

Watershed/ water body	**Sample Date**	**OWMID #s**	**Analyte**	**Censored/ Qualified**	**Reason**
Ganawatte Pond	7/15	LB-0027, 28	TP	Qualify (d)	Split rpd's = 31% (minor exceedance of DQO)
Lower Mystic Lake	8/5	LB-0416, 417	TP	**Censor (d)**	Split rpd = 142% (major exceedance of DQO)
Lower Mystic Lake	8/5	LB-0418, 419, 420 and 425	TP	Qualify (d)	Split rpd = 142% indicates very poor reproducibility for survey samples
Ganawatte Pond	8/12	LB-0181, 182, 185	TP	**Censor (m)**	Sample filtered after digestion, due to iron floc problem (current recommendation for this type of sample is not to filter)
Turners Pond	9/21	LB-0343	TP	**Censor (m)**	Not analyzed; broken bottle indicated on field sheet
Turners Pond	8/24	LB-0189, 190,191 and 193	TP	Accept without qualification	Very minor exceedance of analytical holding time (29/28); not enough justification to discard or qualify data)

Table A5. Continued. 1999 DEP DWM Censored/Qualified Boston Harbor Data.

Lower Mystic Lake	8/24	LB-0195, 196, 198, 200, 427, 428	TP	Accept without qualification	Very minor exceedance of analytical holding time (29/28); not enough justification to discard or qualify data)
Ganawatte Farm Pond (primary; other lakes' samples in batch run affected)	9/13	LB-0327, 328; also 0280, 282, 279, 281, 285, 286, 334, 328, 333, 330, and 329	Color	Qualify (d)	Field Split rpd = 46% (major exceedance of DQO; not enough justification to discard data, but batch run qualified
Turners Pond (primary; other lakes' samples in batch run affected)	8/24	LB-0189, 190; also 191, 193, 195 and 196	Color	Qualify (d)	Field Split rpd = 54% (major exceedance of DQO; not enough justification to discard data, but batch run qualified
Ganawatte Farm Pond (primary; other lakes' samples in batch run affected)	8/11, 8/12	LB-0181, 182; also 0163, 164, 169, 170, 177, 179, and 185	Color	Qualify (d)	Field Split rpd = 53% (major exceedance of DQO; not enough justification to discard data, but batch run qualified
Ganawatte Farm Pond (primary; other lakes' samples in batch run affected)	7/15	LB-0027, 0028; also 0029, 0030, 0033, and 0034	Color	Qualify (d)	Field Split rpd = 62% (major exceedance of DQO; not enough justification to discard data, but batch run qualified
Newfield Pond	7/13	LB-0003	Color	**Censor (m)**	Ambient field blank taken (LB-0003), but not analyzed or reported.
Newfield Pond (primary; other lakes' samples in batch run affected)	7/13	LB-0001, 0002, and 0005	Color	Qualify (m)	Ambient field blank taken (LB-0003), but not analyzed or reported; survey run qualified
Winter Pond (primary; other lakes' samples in batch run affected)	7/13	LB-0008 and 0010	Color	Qualify (m)	Ambient field blank taken, but not analyzed or reported; survey run qualified
Lower Mystic Lake	8/5	LB-0425	Alkalinity	**Censor (m)**	Sample deliberately discarded
Winter Pond	7/13	LB-0009	Chlorophyll a	Qualify (b)	Blank contamination
Ganawatte Farm Pond	7/15	LB-0031	Chlorophyll a	**Censor (m)**	Cross contamination; unreasonably high bias
Cobbs Pond	7/15	LB-0035	Chlorophyll a	**Censor (m)**	Cross contamination; unreasonably high bias
Turners Pond	7/27	LB-0042	Chlorophyll a	Qualify (b)	Blank contamination
Turners Pond	8/26	LB-0192	Chlorophyll a	**Censor (h)**	Hold Time exceeded
Lower Mystic Lake	8/24	LB-0197	Chlorophyll a	**Censor (h)**	Hold Time exceeded
Lower Mystic Lake	9/22	LB-0441	Chlorophyll a	**Censor (p)**	Sample froze in fridge prior to filtering/extraction
Winter Pond	9/7	LB-309	Chlorophyll a	**Censor (m)**	Sample not analyzed at lab; not reported

A5.3 1999 Benthic Macroinvertebrate, Habitat Assessment and Fish Population Data

Based on review of the Boston Harbor 1999 Biological Assessment (Appendix C) and discussions with DWM biologists, there was no reason found to censor or qualify any of the information gathered as part of the 1999 benthic/habitat/fish population surveys.

A5.4 Fish Toxics Data (1999 and 1994)

All fish tissue data from the Boston Harbor basins gathered in 1999 and 1994 are acceptable and usable. The results and conclusions contained in DWM's 1999 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys report are valid.

A5.4.1 1999 Boston Harbor Fish Toxics Data

Relevant QC information for 1999 fish toxics data are provided in the Tables A6 through A10 below.

All fish tissue data passed QC acceptance limits of the WES laboratory and lab-validated data were reported by WES without qualification (i.e., the quality control acceptance limits of WES for analytical accuracy and precision were met for all samples). Sample holding times prior to analysis and extract holding times prior to GC injection were met for all samples. Although detailed data quality objectives (DQOs) for the 1999 Boston Harbor fish contaminant monitoring were not developed, the analytical QC data showed lack of blank contamination; quality control sample, fortified blank and matrix spike recoveries ranging from 67-120 % for all analyte groups; and RPDs less than 30 % for all lab duplicates, with the notable exception of a 49.2 % RPD for mercury.

Lab duplicate precision estimates for metals (Hg, Pb, Cd, As and Se) ranged from 0-49%. Since there were no field duplicates (additional three fish composite of one species) taken, estimates of overall precision (as RPD) were not possible; precision data provided here is based on lab duplicates. Although DWM now typically collects two same-specie, three-fish composites from the same waterbody at a rate of 10% of waterbodies sampled (as a field "duplicate"), this was not performed in 1999 for the Boston Harbor samples. While this information would have been helpful in assessing in-lake/in-river variability in tissue concentrations for same-specie fish, lack of field duplicates does not render the 1999 fish tissue data unusable. The 49 % RPD for mercury is greater than a typical tissue metals DQO for precision of 30 %, and indicates potential significant problems with repeatability for mercury quantitation for that specific WES batch run. Although no mercury data has been qualified, review and use of mercury data from that batch run should take this into account.

Lab accuracy estimates for metals using fortified blanks, matrix spikes and QC samples ranged from 78 to 113 % recovery for all analytes. These values meet acceptance criteria.

Lab accuracy estimates for organic contaminants using lab-fortified blanks ranged from 67-102 % recovery for all analytes tested. Lab-fortified matrix (LFM) samples using PCB arochlors and selected pesticides ranged from 94-120 %. All lab organics blanks showed non-detectable concentrations. These values meet acceptance criteria.

Lab duplicate data for DDT and the congenor BZ#118 were acceptable (15.4 and 10.5, respectively). Lab fortified matrix samples showed good recoveries, ranging from 94-120 % for LFM and LFM duplicates.

Table A6. 1999 DEP DWM laboratory QA/QC blank data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	LABORATORY SAMPLE NUMBER	ANALYTE		
		% Lipid	Pesticides	PCBs
2 December 1999	BLANK - 1	0.07	ND	ND
3 December 1999	BLANK - 2	0.09	ND	ND
7 December 1999	BLANK - 3	0.09	ND	ND
8 December 1999	BLANK - 4	0.08	ND	ND
9 December 1999	BLANK - 5	0.07	ND	ND
10 December 1999	BLANK - 6	0.09	ND	ND
14 December 1999	BLANK - 7	0.07	ND	ND
15 December 1999	BLANK - 8	0.15	ND	ND
16 December 1999	BLANK - 9	0.16	ND	ND
17 December 1999	BLANK - 10	0.10	ND	ND
21 December 1999	BLANK - 11	0.12	ND	ND
22 December 1999	BLANK - 12	0.09	ND	ND

ND - Not detected or the analytical result is at or below the established method detection limit (listed in section A6).

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC blank data for organics in fish tissue are pertinent to Boston Harbor samples.

Table A7. 1999 DEP DWM Boston Harbor Watershed laboratory QA/QC data for metals in fish tissue. (Data expressed in mg/Kg wet weight unless otherwise noted.)

		Precision			Accuracy				
Sample ID	Analyte	Sample	Duplicate	Relative Percent Difference	Spike Amount	Lab Fortified Matrix (%)	Lab Fortified Blank (%)	Quality Control Sample (%)	Method Detection Limit
L990271-1	Hg	0.23	0.38	49.2	0.002	82	110	113	0.02
L990271-1	Pb	<MDL	<MDL	NA	20	94	92	107	0.20
L990271-1	Cd	<MDL	<MDL	NA	20	97	93	93	0.02
L990271-1	As	<MDL	<MDL	NA	2.0	84	105	91	0.04
L990271-1	Se	0.307	0.292	5.0	2.0	83	100	93	0.04
L990227-1	Pb	<MDL	<MDL	NA	20	90	96	90	0.2
L990227-1	Cd	<MDL	<MDL	NA	20	94	98	96	0.02
L990227-1	Se	0.299	0.247	19.0	2.0	78	106	106	0.04
L990227-1	As	0.079	0.079	0.0	2.0	111	109	107	0.04

MDL - Method Detection Limit
NA - Not Applicable

Table A8. 1999 DEP DWM laboratory QA/QC lab fortified blank data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	2 December 1999	7 December 1999	8 December 1999	14 December 1999	16 December 1999
LABORATORY SAMPLE NUMBER	Laboratory Fortified Blank #1	Laboratory Fortified Blank #2	Laboratory Fortified Blank #3	Laboratory Fortified Blank #4	Laboratory Fortified Blank #5
%LIPIDS	0.10	0.07	0.10	0.07	0.08
ANALYTE	PCB A1260 MDL 0.11	Chlordane MDL 0.11	PCB A1242 MDL 0.26	Toxaphene MDL 0.59	Lindane MDL 0.009 Heptachlor MDL 0.012 Aldrin MDL 0.016 DDT MDL 0.011
Spike Amount	0.96	0.98	1.0	0.96	Lindane 0.010 Heptachlor 0.010 Aldrin 0.010 DDT 0.020
Spike Recovered	0.95	1.0	0.67	0.91	Lindane 0.0098 Heptachlor 0.0115 Aldrin 0.0120 DDT 0.0255
Spike % Recovery	99	102	67	95	Lindane 98 Heptachlor 115 Aldrin 120 DDT 128

MDL – method detection limit

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC lab fortified blank data for organics in fish tissue are pertinent to Boston Harbor samples.

Table A9. 1999 DEP DWM laboratory QA/QC duplicate data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	LABORATORY SAMPLE NUMBER	ANALYTE		
		Pesticides*	PCBs*	% Lipid
3 December 1999	L990067-7	DDE 0.012 DDT 0.012	BZ# 118 0.0030	0.22
	L990067-7 duplicate	DDE 0.012 DDT 0.014	BZ# 118 0.0027	0.19
	relative percent difference	DDE 0% DDT 15.4%	BZ# 118 10.53%	15%
10 December 1999	L990178-24	ND	ND	0.20
	L990178-24 duplicate	ND	ND	0.23
	relative percent difference	NA	NA	14%
15 December 1999	L990212-3	ND	ND	0.63
	L990212-3 duplicate	ND	ND	0.63
	relative percent difference	NA	NA	0%

NA - not applicable
ND - not detected
* Fish tissue organic analytes (listed in Section A6) not appearing in the above table were included in the analysis and were not detected.
NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC duplicate data for organics in fish tissue are pertinent to Boston Harbor samples.

Table A10. 1999 DEP DWM laboratory QA/QC lab fortified matrix and matrix spike duplicate data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	21 December 1999	21 December 1999	23 December 1999	23 December 1999
LABORATORY SAMPLE NUMBER	Matrix Spike L990227-2	Matrix Spike Duplicate L990227-2	Matrix Spike L990271-1	Matrix Spike Duplicate L990271-1
%LIPIDS	0.20	0.19	0.11	0.20
ANALYTE	PCB A1260 MDL 0.11	PCB A1260 MDL 0.11	Lindane MDL 0.009 Heptachlor MDL 0.012 Aldrin MDL 0.016 DDT MDL 0.011	Lindane MDL 0.009 Heptachlor MDL 0.012 Aldrin MDL 0.016 DDT MDL 0.011
SPIKE AMOUNT	1.14	1.14	Lindane 0.025 Heptachlor 0.025 Aldrin 0.025 DDT 0.050	Lindane 0.025 Heptachlor 0.025 Aldrin 0.025 DDT 0.050
SPIKE RECOVERED	1.08	1.07	Lindane 0.026 Heptachlor 0.024 Aldrin 0.026 DDT 0.052	Lindane 0.026 Heptachlor 0.027 Aldrin 0.028 DDT 0.060
SPIKE % RECOVERY	95	94	Lindane 104 Heptachlor 96 Aldrin 104 DDT 104	Lindane 104 Heptachlor 108 Aldrin 112 DDT 120

MDL – method detection limit
NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC lab fortified matrix data for organics in fish tissue are pertinent to Boston Harbor samples.

A5.4.2 1994 Boston Harbor Fish Toxics Data

DWM finds all 1994 fish tissue data from the Boston Harbor watershed to be acceptable and usable. All fish tissue data passed QC acceptance limits of the WES laboratory and lab-validated data were reported by WES without qualification. Field and laboratory SOPs are documented in the 1994 DEP fish toxics report (MADEP 1994).

Lab duplicate precision estimates for metals (Hg, Pb, Cd, As and Se) were generally 24% RPD or less. These values meet acceptance criteria. Lab accuracy estimates for metals using fortified sample matrix samples ranged from 64 to 127 % recovery for all analytes (one Se matrix sample had 64% recovery; although the quality control sample for Se was better at 80%, there may have been significant matrix effects compromising the accuracy of sample analysis for Se). Lab accuracy estimates for metals using lab-fortified blanks ranged from 73-132 % recovery, and for QC samples ranged from <MDL (Pb on two occasions) to 120 % recovery for all analytes. On two occasions, QC samples for Pb showed < MDL. This indicates that sample results for lead (Pb) for the associated batches may have significant error.

All lab organics blanks showed non-detectable concentrations. Lab duplicate data showed non-detectable concentrations for all analytes tested (this meets acceptance criteria, although does not allow for precision estimates as RPD). Lab fortified matrix sample spike/spike duplicate recovery using PCB arochlor 1260 was 146%, and that for lindane, heptochlor, aldrin and DDT were 63%, 91%, 109% and 64%, respectively. This indicates potential error in the associated batch analysis of lindane and DDT.

Although the metals and organics data have been accepted without qualification, potential users of data involving poor quality control (as referenced above) are advised to consider the potential error in sample data for specific analytes.

Relevant QC information for 1994 fish toxics data is provided in Tables A11 through A14 below. There were no field duplicate QC samples taken in 1994. Users should take the age of the data into account; 1994 data is not as usable as 1999 or more recent data in determining fish health or edibility.

Table A11. 1994 DEP OWM laboratory QA/QC data for metals in fish tissue. (Data expressed in mg/kg wet weight unless otherwise noted.)

		Precision			LFM Accuracy					Accuracy (% Recovery)			
Sample ID	Analyte	Sample	Duplicate	RPD	Spike Amount	Spike Recovered	Spike Recovery (%) (WES LFM)	Sample Mean	LFM (spike + sample)	LFB	QCS	MDL	Analytical Method
94-4636	As	<MDL	<MDL	NA	NR	NA	78	NA	NA	75	98	0.040	EPA 200.9
94-4636	Se	0.169	0.172	1.8	NR	NA	72	NA	NA	132	92	0.040	EPA 270.2
94-4636	Cd	<MDL	<MDL	NA	NR	NA	116	NA	NA	106	96	0.20	EPA 213.1
94-4636	Pb	<MDL	<MDL	NA	NR	NA	110	NA	NA	96	90	1.00	EPA 239.1
94-4254	As	<MDL	<MDL	NA	NR	NA	84	NA	NA	73	111	0.04	EPA 200.9
94-4254	Pb	<MDL	<MDL	NA	NR	NA	113	NA	NA	117	97	1.0	EPA 239.1
94-4254	Cd	<MDL	<MDL	NA	NR	NA	87	NA	NA	101	115	0.20	EPA 213.1
94-4254	Se	0.084	0.078	7.4	NR	NA	72	NA	NA	87	76	0.04	EPA 270.2
94-3967	Se	0.203	0.178	13.1	NR	NA	104	NA	NA	118	87	0.002	EPA 270.2
94-3967	As	0.041	<MDL	2.5	NR	NA	80	NA	NA	70	109	0.04	EPA 200.9
94-3967	Pb	<MDL	<MDL	NA	NR	NA	70	NA	NA	80	80	0.05	EPA 200.7A
94-3967	Cd	<MDL	<MDL	NA	NR	NA	110	NA	NA	80	100	0.03	EPA 200.7A
94-3613	As	<MDL	<MDL	NA	NR	NA	96	NA	NA	117	67	0.04	EPA 200.9
94-3613	Se	0.14	0.13	7.4	NR	NA	127	NA	NA	91	114	0.002	EPA 270.2
94-3613	Cd	<MDL	<MDL	NA	NR	NA	100	NA	NA	100	100	0.03	EPA 213.1
94-3613	Pb	<MDL	<MDL	NA	NR	NA	110	NA	NA	110	<MDL	0.05	EPA 239.1
94-2530	Se	<MDL	<MDL	NA	NR	NA	64	NA	NA	93	80	0.002	EPA 270.2
94-2529	As	<MDL	<MDL	NA	NR	NA	75	NA	NA	89	91	0.04	EPA 200.9
94-2529	Pb	<MDL	<MDL	NA	NR	NA	98	NA	NA	97	98	0.03	EPA 239.1
94-2529	Cd	<MDL	<MDL	NA	NR	NA	102	NA	NA	90	100	0.01	EPA 213.1
94-3064	As	<MDL	<MDL	NA	NR	NA	85	NA	NA	89	90	0.04	EPA 200.9
94-3064	Cd	<MDL	<MDL	NA	NR	NA	100	NA	NA	100	100	0.01	EPA 213.1
94-3064	Pb	<MDL	<MDL	NA	NR	NA	90	NA	NA	110	<MDL	0.03	EPA 239.1
94-3064	Se	0.09	0.09	0	NR	NA	118	NA	NA	92	80	0.002	EPA 270.2
94-3975	Hg	0.16	0.16	0	NR	NA	108	NA	NA	110	110	0.0002	EPA 245.1
94-4228	Hg	1.07	1.05	1.9	NR	NA	98	NA	NA	104	110	0.0002	EPA 245.1
94-3062	Hg	0.064	0.063	1.6	NR	NA	96	NA	NA	100	110	0.0002	EPA 245.1
94-3540	Hg	0.082	0.102	21.7	NR	NA	88	NA	NA	99	115	0.0002	EPA 245.1
94-4160	Hg	0.373	0.333	11.3	NR	NA	90	NA	NA	110	120	0.0002	EPA 245.1
94-4650	Hg	0.090	0.115	24.4	NR	NA	92	NA	NA	105	110	0.0002	EPA 245.1
94-2530	Hg	0.112	0.100	11.3	NR	NA	99	NA	NA	90	100	0.0002	EPA 245.1

LFB - Laboratory Fortified Blank
LFM - Laboratory Fortified Matrix
MDL - Method Detection Limit
NA - Not Applicable

NR - Not Reported
QCS - Quality Control Sample
RPD - Relative Percent Difference

LFM Calculation: SA x %SR = SR ; SR + SM = LFM

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC data for metals in fish tissue are pertinent to Boston Harbor samples.

Table A12. 1994 DEP OWM laboratory QA/QC blank data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	LABORATORY SAMPLE NUMBER	ANALYTE		
		% Lipid	Pesticides	PCBs
15 February 1995	BLANK - 50	0.19	ND	ND
16 February 1995	BLANK - 51	0.26	ND	ND
17 February 1995	BLANK - 52	0.17	ND	ND

ND - Not detected or the analytical result is at or below the established method detection limit (listed in Table A5.5.1).

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC data for metals in fish tissue are pertinent to Boston Harbor samples.

Table A13. 1994 DEP OWM laboratory QA/QC duplicate data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors and Congeners and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	LABORATORY SAMPLE NUMBER	ANALYTE		
		Pesticides*	PCBs*	% Lipid
16 February 1995	94-4164	ND	ND	1.1%
	94-4164 duplicate	ND	ND	1.1%
	relative percent difference	NA	NA	0%
17 February 1995	94-4653	ND	ND	0.68
	94-4653 duplicate	ND	ND	0.49
	relative percent difference	NA	NA	32

NA - not applicable

ND - not detected

* Fish tissue organic analytes (listed in Table A5.5.1) not appearing in the above table were included in the analysis and were not detected.

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC data for metals in fish tissue are pertinent to Boston Harbor samples.

Table A14. 1994 DEP OWM laboratory QA/QC lab fortified matrix data for organics in fish tissue. The analytes were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCBs and Organochlorine Pesticides. (Data expressed in µg/g wet weight unless otherwise noted.)

DATE ANALYZED	14 February 1995	15 February 1995
LABORATORY SAMPLE NUMBER	Laboratory Spike - 29	Laboratory Spike - 30
%LIPIDS	0.35	0.22
ANALYTE*	PCB A1260 MDL 0.16	Lindane MDL 0.16 Aldrin 0.15 Heptachlor 0.08 DDT 0.25
SPIKE AMOUNT	NR	Lindane NR Aldrin NR Heptachlor NR DDT NR
SPIKE RECOVERED	NR	Lindane NR Aldrin NR Heptachlor NR DDT NR
SPIKE % RECOVERY	146	Lindane 63 Aldrin 109 Heptachlor 91 DDT 64

MDL – method detection limit

NR – not reported

* Fish tissue organic analytes (listed in Table A5.5.1) not appearing in the above table were included in the analysis and were not detected.

NOTE: Boston Harbor samples were batched with others. These laboratory QA/QC data for metals in fish tissue are pertinent to Boston Harbor samples.

A6. Analytical Methods

The laboratory analytical methods used at WES to generate data used in this assessment report are provided in Table A15.

Table A15. 1999 and 1994 Analytical Methods and Method Detection Limits (MDLs).

Analytes	EPA Method*	SM Methods**	Other Methods	MDLs (1999)	MDLs (1994)
Discrete Water Sample Analytes					
Fecal Coliform		SM 9222D		<6, <16 CFU/100ml	NA
E. Coli, MTEC		SM 9213D		NA	NA
Enterococcus		SM 9230C		NA	NA
Alkalinity		SM 2320B		1.0, 2, 2.0 mg/l	NA
Chloride (4500)		SM 4500CL-B		1, 1.0 mg/l	NA
Hardness	EPA 200.7			0.6, 0.66 mg/l	NA
Turbidity	EPA 180.1			0.10, 0.1 NTU	NA
Ammonia-N	EPA 350.1			0.02 mg/l	NA
Nitrate/Nitrite-N	EPA 353.1			0.02 mg/l	NA
Suspended Solids		SM 2540D		1.0, 2.5 mg/l	NA
Total Kjeldahl Nitrogen	EPA351.2			0.10 mg/l	NA
Dissolved Reactive Phosphorus		SM4500P E		0.005 mg/l	NA
Total Reactive Phosphorus		SM4500P E		0.01 mg/l	NA
Total Phosphorus (Manual)		SM 4500P-E		0.01, 0.005 mg/l	NA
BOD (2,5,7,14,21day)		SM5210B		6.0 mg/l	NA
CBOD (2,5,7,14,21day)		SM5210B		2 mg/l	NA
Chlorophyll *a* (DWM lab)		SM10200H		ND	NA
Apparent Color (DWM lab)		SM2120B		15 pcu	NA
Fish Tissue Analytes					
PCB Arochlor 1242			AOAC 983.21***	0.26 µg/g	0.06 µg/g
PCB Arochlor 1254			AOAC 983.21***	0.37 µg/g	0.17 µg/g
PCB Arochlor 1260			AOAC 983.21***	0.11 µg/g	0.16 µg/g

* = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.
** = Standard Methods, Examination of Water and Wastewater, 20th edition
***= WES SOP *Determination of Chlorinated Pesticides, PCB Aroclor(s) and PCB congeners in Fish and Biological Tissue* (modified AOAC 983.21)
ND – no data
NA – not applicable, not pertinent to data used in this report NOTE: all fish tissue MDL values reported in mass/mass wet weight

Table A15. Continued. 1999 and 1994 Analytical Methods and Method Detection Limits (MDLs).

Analytes	EPA Method*	SM Methods**	Other Methods	MDLs (1999)	MDLs (1998)	MDLs (1994)
Fish Tissue Analytes (continued)						
Chlordane			AOAC 983.21***	0.11 µg/g	0.044 µg/g	0.11 µg/g
Toxaphene			AOAC 983.21***	0.59 µg/g	0.11 µg/g	0.11 µg/g
a-BHC			AOAC 983.21***	0.009 µg/g	0.017 µg/g	0.19 µg/g
b-BHC			AOAC 983.21***	0.011 µg/g	0.014 µg/g	0.09 µg/g
Lindane			AOAC 983.21***	0.009 µg/g	0.012 µg/g	0.16 µg/g
d-BHC			AOAC 983.21***	0.043 µg/g	0.029 µg/g	0.02 µg/g
Hexachlorocyclopentadiene			AOAC 983.21***	0.33 µg/g	0.0077 µg/g	0.10 µg/g
Trifluralin			AOAC 983.21***	0.18 µg/g	0.0062 µg/g	0.11 µg/g
Hexachlorobenzene			AOAC 983.21***	0.18 µg/g	0.0091 µg/g	0.04 µg/g
Heptachlor			AOAC 983.21***	0.012 µg/g	0.013 µg/g	0.08 µg/g
Heptachlor Epoxide			AOAC 983.21***	0.015 µg/g	0.013 µg/g	0.59 µg/g
Methoxychlo			AOAC 983.21***	0.029 µg/g	1.07 µg/g	1.07 µg/g
DDD			AOAC 983.21***	0.011 µg/g	0.010 µg/g	0.13 µg/g
DDE			AOAC 983.21***	0.010 µg/g	0.014 µg/g	0.39 µg/g
DDT			AOAC 983.21***	0.011 µg/g	0.013 µg/g	0.25 µg/g
Aldrin			AOAC 983.21***	0.016 µg/g	0.0092 µg/g	0.15 µg/g
BZ#81			AOAC 983.21***	0.0005 µg/g	NA	NA
BZ#77			AOAC 983.21***	0.0005 µg/g	NA	NA
BZ#123			AOAC 983.21***	0.0011 µg/g	NA	NA
BZ#118			AOAC 983.21***	0.0025 µg/g	NA	NA
BZ#114			AOAC 983.21***	0.0008 µg/g	NA	NA
BZ#105			AOAC 983.21***	0.0019 µg/g	NA	NA
BZ#126			AOAC 983.21***	0.0004 µg/g	NA	NA
BZ#167			AOAC 983.21***	0.0009 µg/g	NA	NA
BZ#156			AOAC 983.21***	0.0007 µg/g	NA	NA

* = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.

** = Standard Methods, Examination of Water and Wastewater, 20th edition

***= WES SOP *Determination of Chlorinated Pesticides, PCB Aroclor(s) and PCB congeners in Fish and Biological Tissue* (modified AOAC 983.21)

ND – no data

NA – not applicable, not pertinent to data used in this report

NOTE: all fish tissue MDL values reported in mass/mass wet weight

Table A15. Continued. 1999 and 1994 Analytical Methods and Method Detection Limits (MDLs).

Analytes	EPA Method*	SM Methods**	Other Methods	MDLs (1999)	MDLs (1998)	MDLs (1994)
Fish Tissue Analytes (continued)						
BZ#157			AOAC 983.21***	0.0007 µg/g	NA	NA
BZ#180			AOAC 983.21***	0.0007 µg/g	NA	NA
BZ#169			AOAC 983.21***	0.0003 µg/g	NA	NA
BZ#170			AOAC 983.21***	0.0007 µg/g	NA	NA
BZ#189			AOAC 983.21***	0.0007 µg/g	NA	NA
Arsenic	EPA 200.9			0.04 mg/kg	0.040, 0.04, mg/kg	0.040, 0.04, mg/kg 0.002 mg/L
Lead	EPA 239.1			NA	NA	1.0, 1.00 mg/kg 0.03, 0.05 mg/L
	EPA 200.7			0.20 mg/kg	0.35, 0.19, 0.14, 0.20, 0.2, 0.140, mg/kg	0.05 mg/l
Selenium	EPA 200.9			0.04 mg/kg	0.040, 0.04, mg/kg	NA
	EPA 270.2			NA	NA	0.04, 0.040 mg/kg 0.002 mg/L
Cadmium	EPA 200.7			0.02 mg/kg	0.02, 0.04, 0.020, mg/kg	0.03 mg/l
	EPA 213.1			NA	NA	0.01, 0.20, 0.03 mg/kg
Mercury	EPA 245.6			0.02 mg/kg	0.01, 0.010, 0.020, mg/kg	0.0002 mg/L

* = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.

** = Standard Methods, Examination of Water and Wastewater, 20th edition

***= WES SOP *Determination of Chlorinated Pesticides, PCB Aroclor(s) and PCB congeners in Fish and Biological Tissue* (modified AOAC 983.21)

ND – no data

NA – not applicable, not pertinent to data used in this report

NOTE: all fish tissue MDL values reported in mass/mass wet weight

A7. CONCLUSION

The Boston Harbor data collected in 1999 (and in 1994 for fish toxics) were reviewed with regard to project data quality objectives (DQOs) and adherence to DEP/DWM and WES Laboratory SOPs for collection and analysis. The primary DQO elements of precision, accuracy, representativeness, completeness and comparability (PARCC) were evaluated, as were associated quality control data.

Based on DWM's data validation process, the majority of sample data were accepted without qualification, due mainly to acceptable analytical accuracy and overall precision. For data that did not meet the objectives outlined in Section A4, data were censored or accepted with qualification. These exceptions have been specifically noted in this appendix (refer to appropriate tables in Section A5). Where problems were evident for entire surveys or batched analyses, survey or batch data were censored or qualified, as appropriate.

The 1999 Boston Harbor data are comparable with past and future data collected by DWM and others, based on the use of standardized methods and procedures. Although buckets were used as necessary for sample collection from drop locations in 1999, this technique has been discontinued. Use of the bucket method has been noted and, while its use may affect data quality for solids-related (e.g., TSS, turbidity, nutrients) and bacteria analytes, the 1999 Boston Harbor data are considered comparable to other data collected via other and current grab sampling methods.

The following additional conclusions are evident based on the validation of all 1999 DWM data, and are relevant to Boston Harbor data.

- All qualitative and quantitative fish tissue toxics, benthic macroinvertebrate, aquatic habitat, fish population, and aquatic plant data were accepted without qualification. One specific consideration in using this data is the age of the 1994 fish tissue data; this data is approximately 8 years old and is not as usable as 1999 or more recent data in determining fish health or edibility.

- Hydrolab depth data was frequently compromised (censored/qualified) due to lack of proper depth calibration prior to use (see Table A2).

- The accuracy of Hydrolab conductivity readings was often reduced by using a calibration standard out of the range of all/most survey station conductivities (see Table A2).

- In many instances, the necessary equilibration time was not afforded for the taking of stable Hydrolab readings, resulting in censored/qualified data (see Table A2).

- No light interference problems were noted in 1999 in using the Hydrolab turbidity sensor, as had been observed in 1998.

- On various batch analysis dates, analysis of apparent color by DWM showed high readings (although below the estimated MDL of 15 PCU) for ambient field blanks. This did not result in censored/qualified data, but indicates that precision of readings by different analysts might be improved.

- DWM chlorophyll a analysis indicated high blanks (> MDL) and holding time violations for frozen filters (>24 days) on several occasions, resulting in censored/qualified data (see Table A5).

REFERENCES

Clesceri, L.S., A.E. Greenberg, and A.D. Eaton, (editors). 1998. *Standard Methods for the Examination of Water and Wastewater 20th Edition.* American Public Heath Association, Washington, D.C.

MA DEP. 1994. *1994 Public Request Fish Toxics Monitoring Surveys* report, Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999a. CN 22.0 *QAPP for 1999 Baseline Lakes TMDL.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999b. CN 1.0 *Grab Collection Techniques for DWM Water Quality Sampling, Standard Operating Procedure.* October 25, 1999. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999c. CN 13.0 *Fish Contaminant Monitoring Program, Quality Assurance Project Plan, 1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999d. CN 4.0 *Hydrolab® Series 3 Multiprobe, Standard Operating Procedure.* September 23, 1999. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999e. CN 7.0 *SOP for Benthic Macroinvertebrate Collection and Analysis.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999f. CN 40.0 *SOP for Fish Collection/Preparation for Fish Tissue Analysis.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999g. CN 2.0 *Apparent Color Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999h. CN 3.0 *Chlorophyll a Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999i. Open File. *1999 Hydrolab® QAQC.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2000a. *1999 Data Validation Report.* CN 73.0; 9/2001. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2002. *Draft 2002 Data Validation SOP*, February, 2002. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

APPENDIX B - 1999 DEP DWM BOSTON HARBOR WATERSHED SURVEY RESULTS

INTRODUCTION

The DEP DWM sampled in the Boston Harbor Watershed July through September 1999. Sampling components in selected wadeable streams included macroinvertebrate and habitat quality evaluations, fish population sampling, and fish sampling for organic and metal toxins in edible fillets. Baseline lake survey sampling included *in-situ* Hydrolab® Multiprobe Series 3 analyzer (hereafter referred to as Hydrolab®) measurements, Secchi depth, alkalinity, color, total phosphorus, and chlorophyll *a* sampling as well as macrophyte identification/density at the maximum extent of growth. Each sampling component is described in the sections that follow.

BASELINE LAKE SURVEYS

Mystic, Neponset, and Weymouth & Weir Subwatersheds

One of the nine 303d listed lakes in the Mystic River Subwatershed was selected for baseline surveys. Another pond in the Mystic River Subwatershed not 303d listed was also sampled. Three of the twenty 303d listed lakes in the Neponset River Subwatershed were selected for baseline surveys. One of the five 303d listed lakes in the Weymouth & Weir Subwatershed was selected for baseline surveys. Lakes were preferentially targeted for sampling based on the severity of the nutrient-related problem and the size of the lake (MA DEP 1999a). Those lakes that were listed solely for non-nutrient related issues (e.g., lakes listed for fish consumption advisories) and those with previous diagnostic/feasibility studies were not selected. Baseline surveys were conducted to provide information on the current chemical, physical and biological conditions of the lake system (i.e., in-lake and in the surrounding watershed).

Baseline lake surveys generally included a macrophyte survey conducted once during the late summer at the peak of macrophyte growth (generally in July/August/September). The survey data are used in several ways: 1) to determine if the macrophyte growth causes nuisance conditions such that the lake would be listed or delisted on the state's 303d list for violations of water quality standards; 2) to determine if the lake meets designed uses in the 305b assessments; 3) to record baseline conditions to document changes in density of plant growth following implementation of a TMDL; 4) to document invasive species distributions in the state; and 5) to suggest macrophyte management options for the lake.

Trophic status (an indicator of the productivity level of a lake) is based on the evaluation of data collected during baseline surveys. Parameters used to determine trophic status include; oxygen levels, chlorophyll *a* concentrations, total phosphorus levels, Secchi disk measurements, and macrophyte density determinations.

The data are used to validate Total Maximum Daily Load (TMDL) phosphorus loading models and to document the present trophic conditions as well as assessing the status of lake's designated uses. The total phosphorus data are used to evaluate accuracy of land use loading estimates (Mattson and Isaac 1999) of total phosphorus to lakes by comparing predictions of lake concentrations based on modeling to actual measured lake concentrations. These may be used as a basis for estimation of internal loading or other unmeasured phosphorus sources. Concurrently a lake database will be developed for both 303d development and for 305b evaluation based on lakes that are on the current 303d list. The data contained in this database along with the other data collected are used in TMDL development or to monitor lakes for changes in water quality and nuisance plant growth after TMDL implementation.

MACROINVERTEBRATES

Excerpted from *Boston Harbor Watershed 1999 Biological Assessment* technical memorandum (Fiorentino and Maietta, 2000), which is attached as Appendix C of this Assessment Report.

> The main objectives of biomonitoring in the Boston Harbor watershed were: (a) to determine the biological health of streams within the watershed by conducting assessments based on aquatic

macroinvertebrate communities; and (b) to identify problem stream segments so that efforts can be focused on developing NPDES permits, Water Management Act permits, storm water management, and control of other nonpoint source (NPS) pollution. Specific tasks were:

1. Conduct benthic macroinvertebrate sampling at locations throughout the Boston Harbor watershed.

2. Based upon the macroinvertebrate data, identify river segments within the watershed with potential point/nonpoint source pollution problems; and

3. Using the benthic macroinvertebrate data and supporting water chemistry and field data, assess the types of water quality and/or water quantity problems that are present, and if possible, make recommendations for remedial actions. Provide macroinvertebrate data to DWM's Environmental Monitoring and Assessment Program to be used in making aquatic life use assessments required by Section 305b of the Clean Water Act.

FISH POPULATION

Fish population surveys are conducted to estimate the abundance and diversity of fish species within lakes/ponds or stream reaches. Surveys can include a habitat assessment component. Surveys conducted in 1999 by DWM in the Neponset River Subwatershed were performed in support of the BUDGETS Project being implemented by the Neponset River Watershed Association. The information generated from surveys is used in assessing the level of support of the Aquatic Life Use as defined in the Massachusetts Water Quality Standards

FISH TOXICS MONITORING

Fish toxics monitoring is aimed primarily at assessing human health risks associated with the consumption of freshwater fishes. The program is a cooperative effort between three DEP Offices/Divisions, (Watershed Management, Research and Standards, and Environmental Analysis), the Department of Fisheries and Wildlife Environmental Law Enforcement, and the Massachusetts Department of Public Health (MDPH). Fish tissue monitoring is typically conducted to assess the concentrations of toxic contaminants in freshwater fish, identify waterbodies where those concentrations may pose a risk to human health, and identify waters where toxic contaminants may impact fish and other aquatic life. Fish tissue analysis has been restricted to edible fillets. The fish toxics monitoring was designed to screen the edible fillets of several species of fish representing different feeding guilds (i.e., bottom dwelling omnivores, top-level predators, etc.) for the presence of heavy metals (Pb, Cd, Se, Hg, As), PCBs and organochlorine pesticides. These data are then used by the Massachusetts Department of Public Health in assessing human health risks associated with the consumption of freshwater fishes.

During 1994, DEP OWM (now DEP DWM) monitored one station for toxics in fish flesh in the Weymouth & Weir sub-watershed. Lake Holbrook, a 32-acre water body located in Holbrook was sampled in July as part of Year 2 Watershed Surveys and again in August in response to a Public Request. Sampling for toxics in fish flesh also occurred during 1994 at two sites in the Neponset sub-watershed of the Boston Harbor Drainage Area. Results for Willet Pond, a 200acre water body located in Walpole/Westwood/Norwood and a stretch of the Neponset River in Canton/Norwood are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.*, 1995). During 1999, DEP DWM monitored two stations in the Mystic sub-watershed. Lower Mystic Lake, an 111acre water body located in Arlington/Medford, was sampled for toxics in fish flesh in June 1999 in response to a Public Request. In July 1999, as part of Year 2 Watershed Surveys, the Upper Mystic Lake a 167acre water body located in Winchester/Arlington/Medford was also sampled for toxics in fish flesh.

MATERIALS AND METHODS

The DEP DWM sampling plan matrix for the Boston Harbor Watershed is summarized in Table B1.

Table B1. 1999 DEP DWM Boston Harbor Watershed sampling matrix.

WATERBODY (SEGMENT #)	STATION[1]	June	July	August	September
Mystic River Subwatershed					
Aberjona River (MA71-01)	AR01		M		
Winter Pond (MA71047)	A		B	B	B
Upper Mystic Lake	F0080		T		
Unnamed tributary to Lower Mystic Lake	C				B
Lower Mystic Lake	D				B
	F0081	T			
	B			B	B
	A			B	B
Mill Brook	MI01		M		
Neponset River Subwatershed					
Ganawatte Farm Pond (MA73037)	A		B	B	B
Mill Brook (MA73-08)	MB01		M, P		
Cobbs Pond (MA73009)	A		B	B	B
Hawes Brook (MA73-16)	NE09		M, P		
Traphole Brook (MA73-17)	5B01		M, P		
East Branch (locally known as Canton River) (MA73-05)	NE12		M, P		
Pequid Brook (MA73-22)	PB01		M, P		
Massapoag Brook (MA73-21)	9BOB		M, P		
Beaver Brook (MA73-19)	BB01		M, P		
Beaver Meadow Brook (MA73-20)	BM01		M, P		
Unnamed Tributary to Steep Hill Brook (MA73-32)	SB01		M, P		
Turners Pond (MA73059)	A		B	B	B
Weymouth & Weir Subwatershed					
Old Quincy Reservoir* (MA74017)	A		B*		
Monatiquot River (MA74-08)	MR01		M		
Old Swamp River (MA74-03)	SR01		M		
Weir River (MA74-02)	WR01		M		

[1] Sampling did not necessarily occur at the same exact location although that which occurred in the general vicinity of the sampling station is listed together.

B – Baseline lake monitoring. Can include: Hydrolab® Multiprobe meter (depth, pH, dissolved oxygen, conductivity, temperature, total dissolved solids, turbidity) and secchi depth, alkalinity, color, total phosphorus, and chlorophyll *a*.

M – Macroinvertebrate sampling and habitat assessment

P – Fish population sampling

T – Toxics in fish tissue (Cd, Pb, Hg, As, Se, % lipids, PCBs, organochlorine pesticides)

* No data collected, see Baseline Lake Survey Materials and Methods, and Results sections for details.

Note: Fish toxics monitoring was conducted by DEP OWM in 1994 in the Weymouth and Weir Subwatershed (Lake Holbrook, Holbrook). Data are presented in Table B8. Additional work was done at two sites in the Neponset River Subwatershed. Results are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.*, 1995). Fish toxics monitoring sampling locations are depicted in Figure B2.

BASELINE LAKE SURVEYS

In the Boston Harbor Watershed baseline lake surveys were conducted July, August, and September 1999 to coincide with maximum growth of aquatic vegetation, highest recreational use, and highest lake productivity. Lakes were sampled three times each (generally at monthly intervals) (Figure B1).

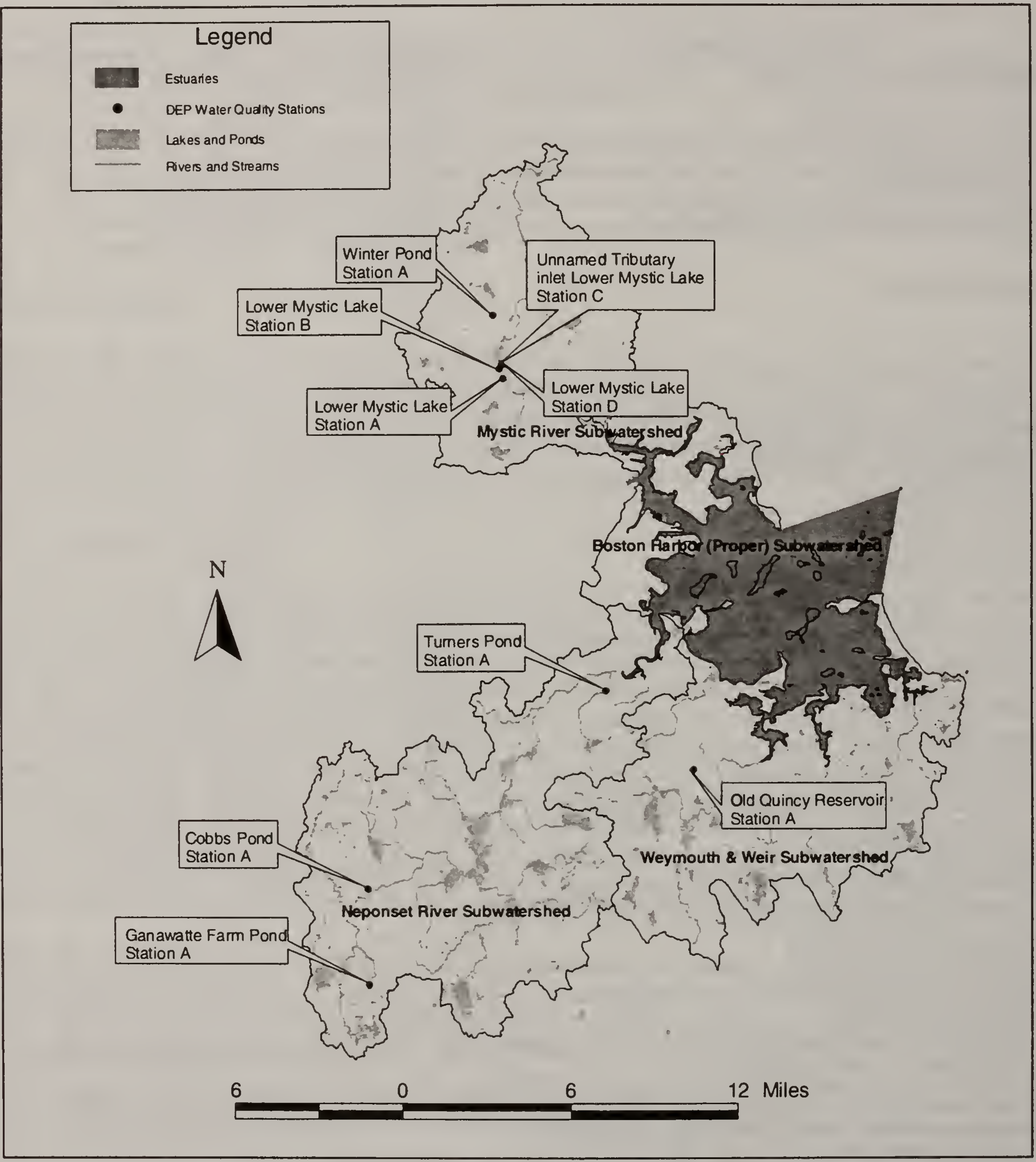
Legend
Estuaries
DEP Water Quality Stations
Lakes and Ponds
Rivers and Streams
Winter Pond Station A
Unnamed Tributary inlet Lower Mystic Lake Station C
Lower Mystic Lake Station B
Lower Mystic Lake Station D
Lower Mystic Lake Station A
Mystic River Subwatershed
Boston Harbor (Proper) Subwatershed
N
Turners Pond Station A
Old Quincy Reservoir Station A
Cobbs Pond Station A
Weymouth & Weir Subwatershed
Neponset River Subwatershed
Ganawatte Farm Pond Station A
6
0
6
12 Miles

Figure B1. 1999 DEP DWM TMDL sampling stations located in the Boston Harbor Watershed.

Mystic River Subwatershed

- The deep hole in the southern basin of Lower Mystic Lake and a second site in the northwest quadrant were sampled the 5th and 24th of August 1999 and again on 21 September 1999. The inlet of Lower Mystic Lake at the spillway/dam in the northern basin was also sampled on 21 September1999.
- The deep hole in the center of the western lobe of Winter Pond was sampled 13 July, 10 August, and 7 September 1999.

Neponset River Subwatershed

- The deep hole near the dam in the southeastern end of Cobbs Pond was sampled on 15 July, 12 August, and 13 September 1999.
- The deep hole in the northern lobe of Ganawatte Farm Pond was sampled on 15 July, 12 August, and 13 September 1999.
- The deep hole in the southeastern quadrant of Turners Pond was sampled on 27 July, 24 August, and 21 September 1999.

Weymouth & Weir Subwatershed

- Sampling of the deep hole near the dam in the northeastern end of Old Quincy Reservoir was unsuccessful due to lack of water. The water body had been drained for a dam repair/dredging project slated for completion January of 2001.

BENTHIC MACROINVERTEBRATE STUDIES

A DEP DWM technical memorandum entitled *Boston Harbor Watershed 1999 Biological Assessment* (Fiorentino and Maietta, 2000), presented as Appendix C of this report, details the collection, handling, and processing of aquatic macroinvertebrate samples (as well as the analysis results) from selected sites in the Boston Harbor Watershed during July 1999.

FISH POPULATION

The DWM conducted fish population surveys at nine locations in the Neponset River Subwatershed during July 1999. A technical memorandum by DEP DWM personnel entitled *Boston Harbor Watershed 1999 Biological Assessment* (Fiorentino and Maietta, 2000), presented as Appendix C of this report, details the handling and processing of samples collected as well as results and analysis.

1999 FISH TOXICS

Mystic River Subwatershed

DWM staff collected fish via boat mounted electrofishing gear in the Lower Mystic Lake, (Arlington/Medford) on 24 June 1999 and in the Upper Mystic Lake (Winchester/Arlington/Medford) on 8 July 1999 (Figure B2). Fish were held in an onboard livewell until an appropriate sample size was reached, at which time the fish were placed in an ice filled cooler and brought back to the DWM laboratory for processing. Data for the Upper Mystic Lake (F0080), and the Lower Mystic Lake (F0081) is presented in Table B7. Protocols designed to assure accuracy and prevent cross-contamination of samples were followed for collecting, processing and shipping fish (MA DEP 1999b). Lengths and weights were measured and fish were visually inspected for tumors, lesions, or other anomalies. Scale or pectoral fin spine samples were obtained from each fish to determine age. Fish were filleted (skin off) on glass cutting boards and prepared for freezing. All equipment used in the filleting process was rinsed in tap water to remove slime, scales, and other fluids such as blood, and then re-rinsed in deionized water twice before (and/or after) each sample. Composite samples (single fillets from three like-sized individuals of the same species) targeted for % lipids, PCBs and organochlorine pesticide analysis were wrapped together in aluminum foil. Composite samples targeted for metals analysis were placed in VWR 32-ounce high density polyethylene (HDPE) cups with covers. Individual samples targeted for Hg analysis only were also placed in VWR 32-ounce high density polyethylene (HDPE) cups with covers. Samples were tagged and frozen for subsequent delivery to the Department's Wall Experiment Station (WES).

Methods used at WES for metals analysis include the following:
Mercury is analyzed by a cold vapor method using a Perkin Elmer, FIMS (Flow Injection Mercury System) which uses Flow Injection Atomic Absorption Spectroscopy. Cadmium and lead are analyzed using a Perkin Elmer, Optima 3000 XL ICP – Optical Emission Spectrophotometer. Arsenic and selenium are analyzed using a Perkin Elmer, Zeeman 5100 PC, Platform Graphite Furnace, Atomic Absorption Spectrophotometer.

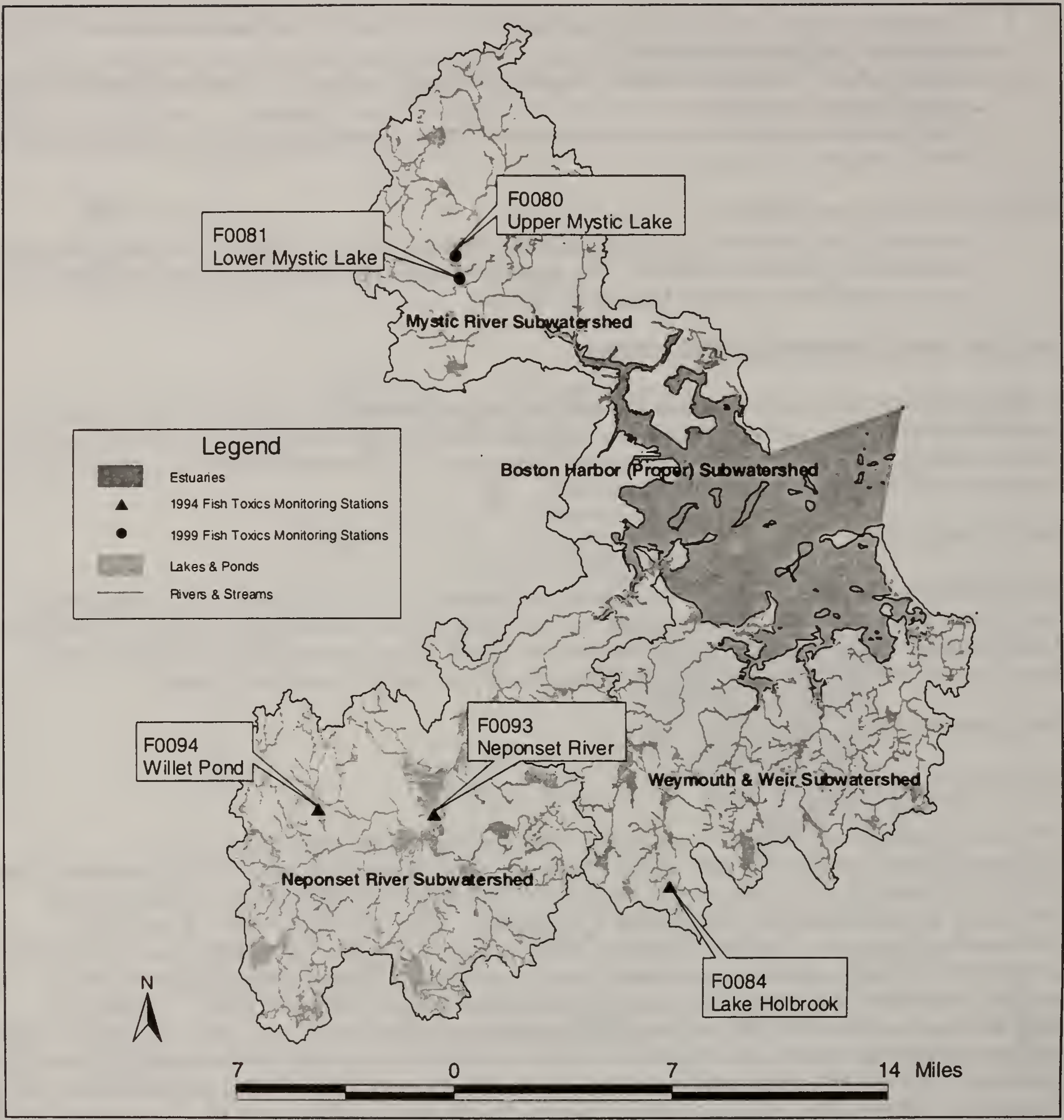
F0080
Upper Mystic Lake
F0081
Lower Mystic Lake
Mystic River Subwatershed
Legend
Estuaries
1994 Fish Toxics Monitoring Stations
1999 Fish Toxics Monitoring Stations
Lakes & Ponds
Rivers & Streams
Boston Harbor (Proper) Subwatershed
F0094
Willet Pond
F0093
Neponset River
Weymouth & Weir Subwatershed
Neponset River Subwatershed
N
F0084
Lake Holbrook
7
0
7
14 Miles

Figure B2. Locations of 1999 and 1994 DEP fish toxics monitoring stations in the Boston Harbor Watershed.

PCB/organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector. Additional information on analytical techniques used at WES is available from the laboratory (MA DEP 1995).

1994 FISH TOXICS

Weymouth & Weir Subwatershed

In July and August 1994, DEP OWM conducted fish toxics monitoring in Lake Holbrook, Holbrook (Figure B2). Using boat-mounted electrofishing gear OWM staff collected fish on 13 July 1994 and then on 19 August trotlines were used. Fish selected for analysis were placed in an ice filled cooler and brought back to the OWM laboratory for processing. Data for Lake Holbrook (F0084) is presented in Table B8.

Neponset River Subwatershed

During July and August 1994, Willet Pond (Walpole/Westwood/Norwood) (F0094) and a portion of the Neponset River in Canton/Walpole (F0093) were monitored for fish toxics (Figure B2). These data are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.*, 1995).

RESULTS

BASELINE LAKE SURVEYS

Mystic River Subwatershed

Fifteen sites were surveyed for macrophytes on Winter Pond, Winchester (MA DEP 1999c). The pond was approximately 25% covered with dense or very dense aquatic plants. Of the plants observed (Table B2), the co-dominant species occurring at greater than 50% of the observation sites were *Nymphaea* sp., *Utricularia* sp., and *Potamogeton epihydrus*. The trophic status is estimated as eutrophic. There was one non-native wetland species (*Lythrum salicaria)* sited at Winter Pond. There were no non-native aquatic species sited at Winter Pond.

No weed mapping was done on Lower Mystic Lake. Only two small areas of macrophytes were observed during a perimeter viewing on 21 September 1999.

Neponset River Subwatershed

Thirty sites were surveyed for macrophytes on Cobbs Pond, Walpole (MA DEP 1999c). The pond was approximately 90% covered with dense or very dense aquatic plants. Of the plants observed (Table B2), the co-dominant species occurring at greater than 50% of the observation sites were *Lythrum salicaria*, *Nymphaea* sp., *Ceratophyllum demersum*, *Lemna* sp., *Wolffia* sp., and *Brasenia schreberi*. The trophic status is estimated as eutrophic. There were non-native wetland (*Lythrum salicaria*) and non-native aquatic (*Myriophyllum heterophyllum)* species sited at Cobbs Pond.

Twenty-five sites were surveyed for macrophytes on Ganawatte Farm Pond, Walpole/Foxborough/Sharon (MA DWM 1999). The pond was approximately 90% covered with dense or very dense aquatic plants. Of the plants observed (Table B2), the co-dominant species occurring at greater than 50% of the observation sites were *Nymphaea* sp., *Lythrum salicaria*, *Brasenia schreberi, Decadon verticillatus*, and *Utricularia vulgaris*. The trophic status is estimated as hypereutrophic. There was one non-native wetland species (*Lythrum salicaria)* sited at Ganawatte Farm Pond. There were no non-native aquatic species sited at Ganawatte Farm Pond.

Eighteen sites were surveyed for macrophytes on Turners Pond, Milton (MA DEP 1999c). The pond was approximately less than 10% covered with dense or very dense aquatic plants. Of the plants observed (Table B2), the co-dominant species occurring at greater than 50% of the observation sites were *Lythrum salicaria*, *Typha latifolia,* macroscopic Algae, and *Nitella* sp. The trophic status is estimated as eutrophic. There was one non-native wetland species (*Lythrum salicaria)* sited at Turners Pond. There were no non-native aquatic species sited at Turners Pond.

Weymouth & Weir Subwatershed

No sampling was done at Old Quincy Reservoir. The water body was drained for a dam repair/dredging project slated for completion January of 2001.

Table B2. 1999 DEP DWM aquatic macrophyte, wetland vegetation, and macroalgae observations at selected 303d listed lakes in the Boston Harbor Watershed. Listed in descending order of frequency with percentage of observations in which plants occurred parenthetical. (n= total number of observation sites)

Mystic River Subwatershed	*Neponset River Subwatershed*		
Winter Pond 71047 **9/9/99** **n=15**	**Cobbs Pond** 73009 **7/7/99** **n=30**	**Ganawatte Farm Pond** 73037 **7/12/99** **n=25**	**Turners Pond** 73059 **7/21/99** **n=18**
Nymphaea sp. (100)	*Lythrum salicaria*[1] (83)	*Nymphaea* sp. (92)	*Lythrum salicaria*[1] (89)
Utricularia sp. (80)	*Nymphaea* sp. (77)	*Lythrum salicaria*[1] (76)	*Typha latifolia (83)*
Potamogeton epihydrus (53)	*Ceratophyllum demersum* (73)	*Brasenia schreberi* (60)	Macroscopic Algae (green, brown, blue-green) (56)
Filamentous Algae (40)	*Lemna* sp. (67)	*Decadon verticillatus* (60)	*Nitella* sp. (50)
Lythrum salicaria[1] (33)	*Wolffia* sp. (67)	*Utricularia vulgaris* (52)	Filamentous Algae (green) (39)
Nitella sp. (33)	*Brasenia schreberi* (63)	*Potamogeton* sp., thin leaf variety (36)	*Pontederia cordata* (33)
Polygonum sp. (33)	*Nuphar* sp. (30)	*Ceratophyllum demersum* (28)	*Sagittaria* sp. (22)
Nymphaea sp. (pink) (20)	*Polygonum* sp. (23)	*Cephalanthus occidentalis (12)*	*Iris* sp. (11)
	Myriophyllum heterophyllum[2] (20)	*Pontederia cordata* (12)	*Nuphar* sp. (11)
	Typha sp. (20)	*Lemna* sp. (8)	*Eleocharis sp. (6)*
	Potamogeton sp., thin leaf variety (13)	*Polygonum* sp. (4)	*Elodea sp. (6)*
	Pontederia cordata (10)		*Nymphaea odorata (6)*
	Utricularia vulgaris (7)		
	Iris sp. (3)		
	Peltandra virginica (3)		
	Sagittaria sp. (3)		

[1] non-native wetland species [2] non-native aquatic species

The *in-situ* Hydrolab® lake data for the Mystic River Subwatershed and the Neponset River Subwatershed are provided in Tables B3 and B4 respectively. Alkalinity, total phosphorus, apparent color, chlorophyll *a*, and Secchi depth data for the Mystic River Subwatershed and the Neponset River Subwatershed are provided in Tables B5 and B6 respectively. These data are managed and maintained in DWM's *Water Quality Data Access Database.*

TABLE B3. 1999 DEP DWM Mystic River Subwatershed *in-situ* Hydrolab® lake data.

Date	OWMID	OWMID QA/QC	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond @ 25 °C (µS/cm)	TDS (mg/l)	DO (mg/l)	SAT (%)
Lower Mystic Lake (Palis: 71027)										
Station: A Description: deep hole, south basin, Arlington/Medford.										
08/05/99	LB-0423		13:01	0.5	26.0 u	9.0	623	399	9.6 u	117 u
			13:05	1.8	25.8	9.0	624	399	9.5	116
			13:11	3.5	24.9	8.6	632	405	8.7	103
			13:18	4.0	22.1 u	7.4	660	422	5.0 u	56 u
			13:24	7.0	13.6	6.8	697	446	<0.2	<2
			13:30	9.6	10.6	6.7	729	467	<0.2	<2
			13:34	10.9	9.3	6.6	767	491	<0.2	<2
			13:39	13.1	8.1	6.6	845	541	<0.2	<2
			13:41	15.0	7.7	6.6	1,016	650	<0.2	<2
			13:41	16.1 m	7.2 m	6.2 m	** cm	** cm	<0.2m	<2m
08/24/99	LB-0199		13:11	0.5	24.0	8.7	610	390	10.0	117
			13:21	2.5	22.8	8.8	609	390	10.3	117
			13:31	4.5	21.7 u	8.1 u	622 u	398 u	7.6 u	85 u
			13:39	5.5	18.4 u	6.9	668	427	0.7	7
			13:51	7.0	14.2	6.7	690	441	<0.2	<2
			13:59	10.0	10.7	6.5	718	459	<0.2	<2
			14:05	12.0	8.7	6.5	788 c	504 c	<0.2	<2
			14:10	14.0	7.9	6.5	914 c	585 c	<0.2	<2
			14:12	15.0 m	7.7 m	6.5 m	999 cm	639 cm	<0.2m	<2m
			14:13	15.9 m	7.3 m	6.3 m	** cm	** cm	<0.2m	<2m
09/21/99	LB-0504		08:55	0.5	19.7	7.3	487	312	7.9	85
			09:00	3.0	19.5	7.2	493	315	7.0	75
			09:07	7.0	18.0	6.8	551	353	1.7 u	18 u
			09:13	7.9	13.3	6.6	710	454	<0.2	<2
			09:17	9.0	11.6	6.5	721 c	461 c	<0.2	<2
			09:27	10.0	10.6	6.5	738 c	473 c	<0.2	<2
			09:32	11.0	9.6	6.5	780 c	499 c	<0.2	<2
			09:38	13.5	8.3	6.5	897 c	574 c	<0.2	<2
			09:44	16.0	7.4	6.3	** c	** c	<0.2	<2
Station: B Description: northwest quadrant of pond, Arlington/Medford.										
08/05/99	LB-0422		10:51	0.4	26.0	9.0	621	397	9.2	112
			10:56	1.7	25.8	9.0	621	397	9.3	113
			11:01	3.3	25.7	8.9	621	398	8.8 u	107 u
			11:05	4.0	22.6 u	7.6	652	417	5.7	66
			11:11	8.0	13.3	6.8	693	444	<0.2	<2
			11:21	12.0	8.2	6.7	761	487	<0.2	<2
			11:29	13.0	7.8	6.8	802	513	<0.2	<2
			11:37	14.5	7.6	6.8	857	548	<0.2	<2
			11:41	15.7 m	7.5 m	6.7 m	981 m	628 m	<0.2m	<2m
08/24/99	LB-0429		14:35	0.5	24.6	8.7	611	391	10.0	118
			14:40	2.5	22.9	8.8	612	392	10.4	119
			14:46	4.5	22.3	8.6	610	390	9.1	103
			14:51	5.5	18.6 u	6.9	665	426	0.8	8
			15:04	7.0	14.1	6.7	682	437	<0.2	<2
			15:11	10.0 m	9.9 m	6.6 m	724 m	463 m	<0.2m	<2m
			15:17	12.0	8.4	6.7	762	487	<0.2	<2
			15:19	15.5 m	7.6 m	6.7 m	896 m	574 m	<0.2m	<2m

" i " = inaccurate readings from Hydrolab® Multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, or lack of calibration of the depth sensor prior to use.

" m " = method not followed; one or more protocols contained in the DWM Hydrolab® SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

" c " = greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

Table B3. Continued. 1999 DEP DWM Mystic River Subwatershed *in-situ* Hydrolab® lake data.

Date	OWMID	OWMID QA/QC	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond @ 25 °C (µS/cm)	TDS (mg/l)	DO (mg/l)	SAT (%)
Lower Mystic Lake (Palis: 71027)										
Station: B	**Description: northwest quadrant of pond, Arlington/Medford.**									
09/21/99	LB-0448		10:42	0.6	19.8	7.4	486	311	8.3	89
			10:47	3.5	19.5	7.3	490	314	7.3	79
			10:50	6.0	19.2	7.1	504	322	5.9	63
			10:57	7.0	17.9	6.8	570	365	1.4 u	15 u
			11:01	8.6	12.0	6.6	718	459	<0.2	<2
			11:06	10.0	10.4	6.6	737 c	472 c	<0.2	<2
			11:11	11.0	9.4	6.6	738 c	473 c	<0.2	<2
			11:15	11.9	8.6	6.7	771 c	493 c	<0.2	<2
			11:20	13.4	8.0	6.7	869 c	556 c	<0.2	<2
Winter Pond (Palis: 71047)										
Station: A	**Description: deep hole, center of western lobe, Winchester.**									
07/13/99	LB-0007		14:04	0.5	24.8	6.8	363	232	7.3	85
			14:10	1.1	24.7	6.9	363	232	7.4	87
08/10/99	LB-0159	LB-0161	13:02	0.5	23.8	8.8	382	245	9.9 u	116 u
			13:09	1.0	22.7	8.2	382	245	9.0	103
	LB-0161	LB-0159	13:21	0.5	23.4 u	8.6 u	383	245	9.4	109
			13:26	1.0	22.8	8.2 u	382	244	8.8	101
09/07/99	LB-0307		13:42	0.5	28.2	7.0	415	266	7.2	91

" i " =	inaccurate readings from Hydrolab® Multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, or lack of calibration of the depth sensor prior to use.
" m " =	method not followed; one or more protocols contained in the DWM Hydrolab® SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.
" u " =	unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.
" c " =	greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

Table B4. 1999 DEP DWM Neponset River Subwatershed *in-situ* Hydrolab® lake data.

Date	OWMID	OWMID QA/QC	Time (24hr)	Depth (m)	Temp (°C)	pH (SU)	Cond @ 25 °C (µS/cm)	TDS (mg/l)	DO (mg/l)	SAT (%)
Cobbs Pond (Palis: 73009)										
Station: A Description: deep hole, south eastern end of pond near dam, Walpole.										
07/15/99	LB-0032		12:25	0.5	21.9	6.5	212	135	3.4	38
			12:31	1.3	20.5	6.3	212	136	0.5	6
08/12/99	LB-0180		13:46	0.5	22.2	6.5	211	135	1.2 u	13 u
			13:52	1.0	21.6	6.4	212	135	0.8 u	9 u
			13:58	1.2	21.0	6.3	216	138	<0.2 u	<2 u
09/13/99	LB-0336		13:16	0.5	21.6 u	6.3	192	123	2.7 u	30 u
			13:25	1.5	20.4	6.1	201	129	0.7 u	7 u
Ganawatte Farm Pond (Palis: 73037)										
Station: A Description: deep hole, northern end of pond, Walpole.										
07/15/99	LB-0036		10:17	0.5	18.8	5.8	139	89.1	<0.2	<2
			10:23	1.0	17.9	5.9	198	127	<0.2	<2
08/12/99	LB-0186		11:10	0.4	19.9	5.7	124	79.6	0.3	3
			11:17	0.7	19.4	5.7	128	81.7	<0.2	<2
09/13/99	LB-0332	LB-0337	10:26	0.5	19.6	5.7	114	72.9	1.2	13
			10:38	0.8	19.3	5.7	115	73.8	0.8	8
	LB-0337	LB-0332	10:48	0.5	19.4	5.7	114	72.8	0.9	10
			10:56	0.8	19.2	5.7	116	74.0	0.8	8
Turners Pond (Palis: 73059)										
Station: A Description: deep hole in southeastern quadrant, Milton.										
07/27/99	LB-0046		09:52	0.5	26.8	9.9	260	167	14.0	173
			09:58	1.5	26.6	9.8	256	164	12.8	157
			10:05	2.5	23.8	6.9 u	246	157	0.4	5
			10:12	3.5	18.8	6.5	263	168	<0.2	<2
			10:17	4.5	13.1	6.4	279	179	<0.2	<2
			10:22	5.5	10.4	6.4	306	196	<0.2	<2
			10:28	6.5	9.5	6.4	348	223	<0.2	<2
08/24/99	LB-0194		09:29	0.5	23.1	7.4	240	154	8.2	94
			09:36	1.5	22.6	7.4	240	154	8.3	94
			09:41	2.5	22.0	6.9	240	153	6.4	72
			09:51	3.5	19.4	6.4	280	179	<0.2	<2
			09:56	4.4	14.4 u	6.4	281	180	<0.2	<2
			10:00	5.5	11.3	6.4	322	206	<0.2	<2
			10:07	6.2	10.3	6.3	341	218	<0.2	<2
09/21/99	LB-0500		13:22	0.5	20.7	7.3	205	131	9.9 u	108 u
			13:27	1.0	20.0	7.1	204	131	9.4	102
			13:31	1.5	19.9	6.9	203	130	8.2	89
			13:36	2.5	19.7	6.6	207	133	6.1	65
			13:41	3.5	19.4	6.3	213	136	1.8	19
			13:47	4.0	18.7	6.5	245	157	<0.2	<2

" i " = inaccurate readings from Hydrolab® Multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, or lack of calibration of the depth sensor prior to use.

" m " = method not followed; one or more protocols contained in the DWM Hydrolab® SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

" c " = greater than **c**alibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

Table B5. 1999 DEP DWM Mystic River Subwatershed *physico-chemical* data.

Date	Time (24hr)	Secchi Depth (m)	Station Depth (m)	OWMID	OWMID QA/QC	Sample Depth (m)	Alkalinity (mg/l)	Color (PCU)	Total Phosphorus (mg/l)	Chlorophyll *a* (mg/m^3)
Lower Mystic Lake (Palis: 71027)										
Station: A		Description: deep hole, south basin, Arlington/Medford.								
08/05/99	**	2.6	22.6							
				LB-0424		0 - 7.0	--	--	--	5
				LB-0419		0.5	55	--	0.015**d**	--
				LB-0420		13.0	59	17	0.22**d**	--
				LB-0425		22.0	****m**	--	22**d**	--
08/24/99	**	2.9	21.5							
				LB-0197		0 - 8.7	--	--	--	****h**
				LB-0195		0.5	58	<15**d**	0.018	--
				LB-0198		7.0	--	--	0.028	--
				LB-0196		13.0	60	<15**d**	0.10	--
09/21/99	10:03	2.1	**							
				LB-0441		0 - 6.0	--	--	--	****p**
				LB-0439		0.5	45	30	0.028	--
				LB-0440		7.0	--	--	0.032	--
				LB-0442		13.0	66	40	0.17	--
Station: B		Description: northwest quadrant of pond, Arlington/Medford.								
08/05/99	**	2.6	16.2							
				LB-0421		** - **	--	--	--	7
				LB-0417	LB-0416	0.5	56	--	****d**	--
				LB-0416	LB-0417	0.5	54	<15	****d**	--
				LB-0418		15.5	79	55	0.59**d**	--
08/24/99	**	**	15.9							
				LB-0200		0.5	--	--	0.013	--
				LB-0427		15.2	--	--	1.0	--
09/21/99	11:30	2.0	13.5							
				LB-0445		** - **	--	--	--	1
				LB-0443		0.5	22	30	0.032	--
				LB-0444		13.5	80	70	0.51	--
Station: D		Description: in northern basin near spillway, Arlington.								
09/21/99	**	**	**							
				LB-0446		0.5	--	--	0.034	--
Winter Pond (Palis: 71047)										
Station: A		Description: deep hole, center of western lobe, Winchester.								
07/13/99	14:01	1.4	1.5							
				LB-0009		** - **	--	--	--	14**b**
				LB-0008		0.5	14	29**m**	0.093	--
				LB-0010		1.0	13	39**m**	0.080	--
08/10/99	13:00	1.1	1.5							
	13:00	1.0		LB-0160		0 - 1.0	--	--	--	5
				LB-0158		0.5	18	60	0.072	--
				LB-0157		0.5	18	55	0.071	--
09/07/99	14:00	>1.1	1.1							
				LB-0309		** - **	--	--	--	****m**
				LB-0308		0.5	20	--	0.091	--

" ** " =	Censored or missing data
" – " =	No data
" **b** " =	**b**lank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
" **d** " =	precision of field **d**uplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP; batch samples may also be affected
" **h** " =	**h**olding time violation (usually indicating possible bias low)
" **m** " =	**m**ethod SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, and lost/unanalyzed samples.
" **p** " =	samples not **p**reserved per SOP or analytical method requirements.

Table B6. 1999 DEP DWM Neponset River Subwatershed *physico-chemical* data.

Date	Time (24hr)	Secchi Depth (m)	Station Depth (m)	OWMID	OWMID QA/QC	Sample Depth (m)	Alkalinity (mg/l)	Color (PCU)	Total Phosphorus (mg/l)	Chlorophyll *a* (mg/m^3)
Cobbs Pond (Palis: 73009)										
Station: A			Description: deep hole, south eastern end of pond near dam, Walpole.							
07/15/99	13:00	1.0	1.8							
				LB-0035		0 - 1.5	--	--	--	**m
				LB-0033		0.5	34	80d	0.18	--
				LB-0034		1.3	33	70d	0.11	--
08/12/99	13:44	1.2	1.8							
				LB-0178		** - 1.3	--	--	--	21
				LB-0177		0.5	40	55d	0.17	--
				LB-0179		1.3	39	75d	0.15	--
09/13/99	13:15	1.0	2.0							
				LB-0335		0 - 1.5	--	--	--	4
				LB-0333		0.5	32	80	0.11	--
				LB-0334		1.5	30	75	0.075	--
Ganawatte Farm Pond (Palis: 73037)										
Station: A			Description: deep hole, northern end of pond, Walpole.							
07/15/99	10:02	0.4	1.5							
				LB-0031		0 - 1.2	--	--	--	**m
				LB-0027	LB-0028	0.5	12	230d	0.030d	--
				LB-0028	LB-0027	0.5	13	120d	0.04d	--
				LB-0030		1.0	15	120d	0.044	--
08/12/99	11:10	0.3	1.2							
				LB-0184		** - 0.7	--	--	--	18
				LB-0182	LB-0181	0.5	14	70Bd	**m	--
				LB-0181	LB-0182	0.5	12	120d	**m	--
				LB-0185		0.7	13	17d	**m	--
09/13/99	10:30	0.5	1.4							
	10:35	0.5		LB-0331		0 - 0.8	--	--	--	1
				LB-0328	LB-0327	0.5	12	70d	0.035	--
				LB-0327	LB-0328	0.5	12	110d	0.034	--
				LB-0330		0.8	12	90	0.032	--
Turners Pond (Palis: 73059)										
Station: A			Description: deep hole in southeastern quadrant, Milton.							
07/27/99	10:45	0.6	7.0							
				LB-0042		0 - 1.8	--	--	--	67b
				LB-0040	LB-0039	0.5	21	40	0.053	--
				LB-0039	LB-0040	0.5	20	44	0.054	--
				LB-0043		6.5	51	960	0.91	--
08/24/99	9:25	1.3	6.7							
				LB-0192		0 - 3.9	--	--	--	**h
				LB-0190	LB-0189	0.5	22	26d	0.037	--
				LB-0189	LB-0190	0.5	23	<15d	0.038	--
				LB-0193		6.2	62	140d	0.95	--
09/21/99	14:05	1.2	4.5							
				LB-0342		** - 4.0	--	--	--	2
				LB-0343		**	44	36	**m	--
				LB-0339	LB-0340	0.5	19	29	0.048	--
				LB-0340	LB-0339	0.5	18	31	0.048	--

" ** " = Censored or missing data

" – " = No data

" b " = blank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).

" d " = precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP; batch samples may also be affected

" h " = holding time violation (usually indicating possible bias low)

" m " = method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, and lost/unanalyzed samples.

" p " = samples not preserved per SOP or analytical method requirements.

FISH POPULATION

Results from the DEP DWM 1999 fish population studies in the Neponset River Subwatershed are presented in Appendix C, *Boston Harbor Watershed 1999 Biological Assessment* (Fiorentino and Maietta, 2000).

FISH TOXICS MONITORING

1999 FISH TOXICS

The results of DEP DWM 1999 fish toxics monitoring surveys are briefly described below for each lake sampled (MA DEP 1999d). These lakes sampled in 1999 are located in the Mystic River Subwatershed of the Boston Harbor Watershed. Survey results are presented in Table B7.

Lower Mystic Lake (Table B7) (F0081)
Samples of largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), white perch (*Morone americana)*, and common carp (*Cyprinus carpi)* were collected from Lower Mystic Lake, Arlington/Medford. The lipids content ranged between 0.15 and 2.1%. Cadmium and lead were not detected in the edible fillets of any sample analyzed for these analytes from Lower Mystic Lake. Arsenic levels ranged from 0.04 to 0.11 mg/kg-wet weight. Selenium levels ranged from 0.17 to 0.31 mg/kg wet weight. Mercury in the fish tissue from Lower Mystic Lake ranged from 0.08 to 0.41 mg/kg-wet weight. PCBs and pesticides were detected in three of the four samples analyzed from Lower Mystic Lake. PCB A1260 ranged from 0.14 to 0.46 µg/g, BZ#105 ranged from 0.0089 to 0.024 µg/g, and BZ#118 was detected at 0.039 µg/g. The pesticide DDD values ranged from 0.015 to 0.064 µg/g and DDE values ranged from 0.013 to 0.070 µg/g. All other PCBs and pesticides were not detected (see Appendix A – Data Validation Report for 1999 DEP/DWM Boston Harbor Drainage Area Monitoring Data for list of analytes and detection limits).

Upper Mystic Lake (Table B7) (F0080)
Samples of largemouth bass, yellow perch, brown bullhead (*Ameiurius nebulosus*), and bluegill (*Lepomis macrochirus*) were collected from Upper Mystic Lake, Winchester/Arlington/Medford. The lipids content ranged between 0.05 and 0.15%. Cadmium, arsenic, PCBs, and lead were not detected in the edible fillets of any sample analyzed for these analytes from Upper Mystic Lake. Selenium levels ranged from 0.12 to 0.34 mg/kg wet weight. Mercury in the fish tissue from Upper Mystic Lake ranged from 0.09 to 0.30 mg/kg-wet weight. The pesticide DDE was detected at values that ranged from 0.012 to 0.016 µg/g. All other pesticides were not detected (see Appendix A – Data Validation Report for 1999 DEP/DWM Boston Harbor Drainage Area Monitoring Data for list of analytes and detection limits).

1994 FISH TOXICS

The results of DEP OWM 1994 fish toxics monitoring surveys (MA DEP 1994a) are briefly described below for the lake sampled in the Weymouth & Weir Subwatershed of the Boston Harbor Drainage Area. Survey results are presented in Table B8. Additional work was done at two sites in the Neponset River Subwatershed of the Boston Harbor Watershed. Results are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.*, 1995).

Lake Holbrook (Table B8) (F0084**)**
Samples of largemouth bass, white perch, yellow perch, and American eel (*Anguilla rostrata)* were collected from Lake Holbrook, Holbrook. The lipids content ranged between 0.16 and 0.72%. Cadmium, arsenic, pesticides, and lead were not detected in the edible fillets of any sample analyzed for these analytes from Lake Holbrook. Selenium levels ranged from non-detect <0.002 to 0.178 mg/kg wet weight. Mercury in the fish tissue from Lake Holbrook ranged from 0.067 to 0.21 mg/kg-wet weight. The PCB A1254 was detected at 0.55 µg/g. All other PCBs were not detected (see Appendix A – Data Validation Report for 1999 DEP/DWM Boston Harbor Drainage Area Monitoring Data for list of analytes and detection limits).

Based on these data no fish consumption advisories were issued for any of the Mystic River or the Weymouth & Weir Subwatershed water bodies of the Boston Harbor Watershed. The additional work done at two sites in the Neponset River Subwatershed did result in fish consumption advisories. Results are presented in *The Neponset River Watershed 1994 Resource Assessment Report* (Kennedy *et al.*, 1995). The most current Fish Consumption Advisory list issued by the MDPH is available online at http://www.state.ma.us/dph/beha/fishlist.htm.]

Table B7. 1999 DEP DWM fish toxics monitoring data for Lower Mystic Lake, (Arlington/Medford), and Upper Mystic Lake (Winchester/Arlington/Medford). Results, reported in wet weight, are from composite samples of fish fillets with skin off.

Sample ID	Collection Date	Species[1] Code	Length (cm)	Weight (g)	Composite Sample ID (lab sample #)	Cd (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	As (mg/kg)	Se (mg/kg)	Lipids (%)	PCB* (µg/g)	Pesticides* (µg/g)
Lower Mystic Lake, (Arlington/Medford) F0081													
MRF99-1	6/24/99	C	52.0	1820	99247 (L990227-1)	<0.02	0.15	<0.20	0.08	0.27	2.1	PCB A1260 = 0.46 BZ#105 = 0.024 BZ#118 = 0.039	DDD = 0.064 DDE = 0.070
MRF99-2	6/24/99	C	52.5	1730									
MRF99-3	6/24/99	C	54.0	2180									
MRF99-4	6/24/99	LMB	41.0	1140	99248 (L990227-2)	<0.02	0.41	<0.20	0.11	0.17	0.21	PCB A1260 = 0.14 BZ#105 = 0.010	DDD = 0.015 DDE = 0.017
MRF99-5	6/24/99	LMB	37.6	780									
MRF99-6	6/24/99	LMB	37.5	880									
MRF99-7	6/24/99	WP	23.9	160	99249 (L990227-3)	<0.02	0.28	<0.20	0.08	0.31	0.16	BZ#105 = 0.0089	DDE = 0.013
MRF99-8	6/24/99	WP	24.2	160									
MRF99-9	6/24/99	WP	21.0	120									
MRF99-10	6/24/99	YP	18.9	80	99250 (L990227-4)	<0.02	0.08	<0.20	0.04	0.30	0.15	ND	ND
MRF99-11	6/24/99	YP	19.7	90									
MRF99-12	6/24/99	YP	18.1	80									
Upper Mystic Lake, (Winchester/Arlington/Medford) F0080													
UML99-1	7/8/99	LMB	38.0	640	99256 (L990271-1)	<0.02	0.30	<0.20	<0.04	0.31			
UML99-2	7/8/99	LMB	33.7	540									
UML99-3	7/8/99	LMB	33.6	550	(L990280-1) duplicate						0.05 0.08	ND ND	DDE = 0.012 DDE = 0.016
UML99-4	7/8/99	YP	25.7	200	99257 (L990271-2)	<0.02	0.20	<0.20	<0.04	0.31			
UML99-5	7/8/99	YP	24.3	160									
UML99-6	7/8/99	YP	24.6	170	(L990280-2)						0.12	ND	ND
UML99-7	7/8/99	B	18.1	120	99258 (L990271-3)	<0.02	0.21	<0.20	<0.04	0.34			
UML99-8	7/8/99	B	19.3	130									
UML99-9	7/8/99	B	18.3	110	(L990280-3)						0.06	ND	ND
UML99-10	7/8/99	BB	29.1	300	99259 (L990271-4)	<0.02	0.09	<0.20	<0.04	0.12			
UML99-11	7/8/99	BB	25.5	170	(L990280-4)						0.15	ND	ND

[1]Species		
	bluegill (B) *Lepomis macrochirus*	largemouth bass (LMB) *Micropterus salmoides*
	brown bullhead (BB) *Ameiurus nebulosus*	white perch (WP) *Morone americana*
	common carp (C) *Cyprinus carpio*	yellow perch (YP) *Perca flavescens*

ND – not detected or the analytical result is at or below the established detection limit (MDL). See Appendix A for MDL.

***Note:** Analytes listed in Appendix A and not appearing in the table were included in the analysis and were not detected

Table B8. 1994 DEP OWM fish toxics monitoring data for Lake Holbrook, Holbrook. Results, reported in wet weight, are from composite samples of fish fillets with skin off.

Sample ID	Collection Date	Species[1] Code	Length (cm)	Weight (g)	Composite Sample ID (lab sample #)	Cd (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	As (mg/kg)	Se (mg/kg)	Lipids (%)	PCB* (µg/g)	Pesticides* (µg/g)
LHF94-1	7/13/94	LMB	39.1	850.0	94001 (94-2529)	<0.01	0.067	<0.03	<0.002	<0.002			
LHF94-2	7/13/94	LMB	37.4	850.0									
LHF94-3	7/13/94	LMB	37.4	820.0	(94-2531)						0.20	ND	ND
LHF94-4	7/13/94	LMB	34.7	700.0									
LHF94-6	7/13/94	WP	18.9	100.0	94002 (94-2530)	<0.01	0.106	<0.03	<0.002	<0.002			
LHF94-7	7/13/94	WP	17.6	90.0									
LHF94-8	7/13/94	WP	17.2	80.0									
LHF94-9	7/13/94	WP	17.6	90.0	(94-2533)						0.49	ND	ND
LHF94-10	7/13/94	WP	17.9	90.0									
LHF94-11	7/13/94	YP	17.0	90.0	94003 (94-2532)	NR	NR	NR	NR	NR	0.16	ND	ND
LHF94-12	7/13/94	YP	17.9	90.0									
LHF94-13	8/19/94	AE	73.1	970	94017 (94-3969)	<0.01	0.21	<0.03	<0.002	0.178			
LHF94-14	8/19/94	AE	66.5	650	(94-3968)						0.72	PCB A1254 0.55	ND

[1] Species

american eel (AE) *Anguilla rostrata*

largemouth bass (LMB) *Micropterus salmoides*

white perch (WP) *Morone americana*

yellow perch (YP) *Perca flavescens*

ND – not detected or the analytical result is at or below the established detection limit (MDL). See Appendix A for MDL.

NR – not requested

***Note:** Analytes listed in Appendix A and not appearing in the table were included in the analysis and were not detected

LAKES

Lake synoptic survey results from 1994 DEP OWM summer surveys in the Neponset River Subwatershed of the Boston Harbor Watershed are presented in Table B9 (MA DEP 1994b).

Table B9. Neponset River Subwatershed 1994 summer lake status. NOTE: All waters are Class B.

LAKE	WATERBODY IDENTIFICATION CODE (WBID)	SIZE ACRES	TROPHIC STATUS ESTIMATE	OBSERVATIONS, Objectionable Conditions
Billings Street/East Street Pond, Sharon	MA73065	3	Eutrophic	Non-native plants (Mh), 100% of surface dense with aquatic plants
Bird Pond, Walpole	MA73002	25	Eutrophic	Non-native plants (Ls), water turbid, ~20% of surface dense with aquatic plants (very dense along northeast shore)
Blue Hills Reservoir, Quincy	MA73004	14	Unknown	Non-native plants (Pa)
Bolivar Pond, Canton	MA73005	22	Eutrophic	Non-native plants (Cc, M. sp,), very turbid (black to brown)
Buckmaster Pond, Westwood	MA73006	27	Mesotrophic	Non-native plants (M. sp,)
Clark Pond, Walpole	MA73008	6	Eutrophic	Non-native plants (Mh, Tn), 100% of surface dense with aquatic plants
Cobbs Pond, Walpole	MA73009	24	Eutrophic	Non-native plants (Ls, M. sp.), 100% of surface very dense with floating or submerged aquatic plants
Crackrock Pond, Foxborough	MA73010	14	Eutrophic	~50% of pond covered with floating vegetation, water low, pond shallow, bottom mucky, organic (possibly fecal) odor emanating from area
Ellis Pond, Norwood	MA73018	19	Eutrophic	Non-native plants (Cc, Ls), surface very densely covered in northeast cove, *Cabomba* around shore of main body
Farrington Pond (Plain Street Pond), Stoughton	MA73040	5	Eutrophic	Non-native plants (Ls, Mh), ~100% of surface covered with floating leaf or submergent plants, deltas created from road runoff
Flynns Pond, Medfield	MA73019	8	Mesotrophic	~33% of surface covered with aquatic plants, south end covered with floating leaf plants, water tea colored
Forge Pond, Canton	MA73020	25	Eutrophic	Non-native plants (Pa), much debris, oozy mud on bottom, very turbid, water depth low, mostly filled in
Ganawatte Farm Pond, Walpole/Sharon/Foxborough	MA73037	55	Eutrophic	>90% of surface dense with aquatic plants, very dark stained water

WBID – Waterbody Identification code.

Non-native Plants: Cc = *Cabomba caroliniana*, **Ls** = *Lythrum salicaria*, Mh = *Myriophyllum heterophyllum*, **Ms** = *Myriophyllum spicatum*, **Mq** = *Marsilea quadrifolia*, Pa = *Phragmites australis*, **Pc** = *Potamogeton crispus*, **Tn** = *Trapa natans*.

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table B9. Continued. Neponset River Subwatershed 1994 summer lake status. NOTE: All waters are Class B.

LAKE	WATERBODY IDENTIFICATION CODE (WBID)	SIZE ACRES	TROPHIC STATUS ESTIMATE	OBSERVATIONS, Objectionable Conditions
Glen Echo Pond, Canton/Stoughton	MA73022	16	Unknown	Non-native plants (M. sp,)
Hammer Shop Pond, Sharon	MA73023	4	Unknown	~50% of pond covered with very dense floating leaf plants
Jewells Pond, Medfield	MA73026	3	Mesotrophic	Scum on surface, turbid water, some fairly dense submerged aquatic plants
Lymans Pond, Westwood	MA73021	26	Eutrophic	100% of surface dense with aquatic plants
Manns Pond, Sharon	MA73028	11	Eutrophic	Non-native plants (Cc, Mq), water very turbid (likely <4' secchi), plants covering littoral zone
Massapoag Lake, Sharon	MA73030	397	Mesotrophic	Non-native plants (Mh), many dead yellow perch washed up on beach (sized 4 to 10 inches most in 5 to 6 inch range)
Memorial Pond, Walpole	MA73012	7	Hypereutrophic	Non-native plants (Ls), dense to very dense patches of weeds cover most of pond, grayish blue translucent turbidity in water, oily sheen on surface in places, much debris on bottom, milky turbidity with yellowish cast toward outlet, shallow
Neponset Reservoir, Foxborough	MA73034	268	Eutrophic	Non-native plants (Cc, Ls, M. sp), aquatic plants very dense in southeast cove area, pond very turbid (from grey-green to brown)
Pinewood Pond, Stoughton	MA73039	21	Eutrophic	Non-native plants (Ls, Mh), 75-100% aquatic plant coverage over entire pond
Plimpton Pond South, Walpole	MA73042	5	Unknown	No longer a pond (marsh area only) channelized through upper end
Ponkapog Pond, Canton	MA73043	203	Mesotrophic	Non-native plants (Ls, Mh, Ms), dense to very dense aquatic plant coverage at beach
Popes Pond, Milton	MA73044	13	Hypereutrophic	Non-native plants (Ls), turbid brown (Secchi <4'), submergent plants very dense at southwest end
Reservoir Pond, Canton	MA73048	243	Mesotrophic	Non-native plants (Cc, Ls, M. sp.), orange-brown stain, much debris on bottom

WBID – Waterbody Identification code.

Non-native Plants: Cc = *Cabomba caroliniana*, **Ls** = *Lythrum salicaria*, **Mh** = *Myriophyllum heterophyllum*, **Ms** = *Myriophyllum spicatum*, **Mq** = *Marsilea quadrifolia*, **Pa** = *Phragmites australis*, **Pc** = *Potamogeton crispus*, **Tn** = *Trapa natans*.

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table B9. Continued. Neponset River Subwatershed 1994 summer lake status. NOTE: All waters are Class B.

LAKE	WATERBODY IDENTIFICATION CODE (WBID)	SIZE ACRES	TROPHIC STATUS ESTIMATE	OBSERVATIONS, Objectionable Conditions
Russell Pond (Pine Tree Pond), Milton	MA73003	6	Eutrophic	Non-native plants (Ls, Pc), ~20% of pond covered with macrophytes, brown turbidity (Secchi <4')
Sprague Pond, Dedham/Boston	MA73053	13	Mesotrophic	Non-native plants (Ls), moderate brown-green turbidity, extensive algal growth on rocks, trash in water (tires, metal, axils, logs...)
Town Pond, Stoughton	MA73056	6	Eutrophic	Non-native plants (Cc, M. sp.), 75-100% aquatic plant coverage likely by end of summer
Turner Pond, Walpole	MA73058	17	Mesotrophic	Non-native plants (Cc), *Cabomba* dense near shore, heavy tea stain
Turners Pond, Milton	MA73059	11	Eutrophic	Non-native plants (Ls), green-grey turbidity (Secchi likely <4'), algal bloom, margin of pond ringed with emergent macrophytes out to 10 feet
Willet Pond, Walpole/Westwood/Norwood	MA73062	200	Unknown	Non-native plants (Ls, M. sp.)
Woods Pond (Stoughton Pond), Stoughton	MA73055	21	Eutrophic	Non-native plants (Ls, M. sp.), 100% aquatic plant density

WBID – Waterbody Identification code.

Non-native Plants: Cc = *Cabomba caroliniana*, **Ls** = *Lythrum salicaria*, **Mh** = *Myriophyllum heterophyllum*, **Ms** = *Myriophyllum spicatum*, **Mq** = *Marsilea quadrifolia*, **Pa** = *Phragmites australis*, **Pc** = *Potamogeton crispus*, **Tn** = *Trapa natans.*

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

REFERENCES

MA DEP. 1994a. Open File. *1994 Fish Toxics Monitoring Data in the Boston Harbor Drainage Area.* Massachusetts Department of Environmental Protection, Office of Watershed Management, Worcester, MA.

MA DEP. 1994b. Open File. *1994 Synoptic Lake Surveys Coding Sheets.* Massachusetts Department of Environmental Protection, Office of Watershed Management, Worcester, MA.

MA DEP. 1995. January Draft. *Laboratory Quality Assurance Plan and Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis. Wall Experiment Station, Lawrence, MA.

MA DEP. 1999a. *Baseline Lake Survey Quality Assurance Project Plan.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999b. CN 13.0. *Fish Contaminant Monitoring Program, Quality Assurance Project Plan, 1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999. Open File. DWM 1999 Lake TMDL Field Sheets. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

MA DEP. 1999d. Open File. *1999 Fish Toxics Monitoring Data in the Boston Harbor Drainage Area.* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Mattson, M. D. and R. A. Isaac. 1999. Calibration of Phosphorous Export Coefficients for Total Maximum Daily Loads of Massachusetts Lakes. *Journal of Lakes and Reservoir Management* 15(3): 209-219.

Fiorentino, J. and R. Maietta. 2000. TM-71-1 Boston *Harbor Watershed 1999 Biological Assessment.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Kennedy, L.K., L.K. O'Shea, W.J. Dunn, Jr., and D. LeVangie. 1995. *The Neponset River Watershed 1994 Resource Assessment Report.* Massachusetts Department of Environmental Protection, Office of Watershed Management, North Grafton and Boston MA.

APPENDIX C- 1999 DEP DWM BIOMONITORING TECHNICAL MEMORANDUM

Technical Memorandum (TM-71-1)

Subject: BOSTON HARBOR WATERSHED 1999 BIOLOGICAL ASSESSMENT

Prepared by: John Fiorentino and Robert Maietta, DEP/ Division of Watershed Management, Worcester, MA

Date: 25 August 2000

INTRODUCTION

Biological monitoring is a useful means of detecting anthropogenic impacts to the aquatic community. Resident biota (e.g., benthic macroinvertebrates, fish, periphyton) in a water body are natural monitors of environmental quality and can reveal the effects of episodic and cumulative pollution and habitat alteration (Barbour et al. 1999, Barbour et al. 1995). Biological surveys and assessments are the primary approaches to biomonitoring.

As part of the Massachusetts Department of Environmental Protection/Division of Watershed Management's (MADEP/DWM) 1999 Boston Harbor watershed assessments, aquatic benthic macroinvertebrate biomonitoring was conducted to evaluate the biological health of various portions of the watershed. A total of 14 biomonitoring stations were sampled to investigate the effects of various point source and nonpoint source stressors—both historical and current—on the aquatic communities of the Mystic River, Weymouth/Weir River, and Neponset River sub-basins. Stream segments in the Mystic River, Weir River and Weymouth River sub-basins were previously "unassessed" by DEP, while historical DEP biomonitoring stations in the Neponset River sub-basin—most recently assessed in 1994 (MA DEP 1995)—were reevaluated to determine if water quality and habitat conditions have improved or worsened over time. In addition, macroinvertebrate and fish sampling conducted by DEP/DWM in the East Branch portion of the Neponset River sub-basin will provide the Neponset River Watershed Association (NepRWA) with biological information to be used in their multi-year project, *Budgets: Balancing Uses with Demands and Generating Effective Techniques for Sustainability* (NepRWA 1998). A multi-phase project, *Budgets* addresses the topic of water resource management and the importance of balancing consumptive water use with instream ecological needs and developing mechanisms and techniques to provide the data necessary for informed decision-making (NepRWA 1999). Sampling locations, along with station identification numbers and dates, are noted in Table 1. Sampling locations are also shown in Figure 1.

To provide information necessary for making basin-wide aquatic life use assessments required by Section 305b of the Clean Water Act, all Boston Harbor watershed stations were compared to a regional reference station thought to represent the "best attainable" conditions in the watershed. Use of a regional reference station is particularly useful in assessing nonpoint source (NPS) pollution impacts (e.g., physical habitat degradation) at upstream control sites as well as downstream sites suspected as chemically-impacted from known point source stressors (Hughes 1989). Regional reference stations were established in Hawes Brook (NE09) and Traphole Brook (5B01)—both in the Neponset River sub-basin. Both stations were situated upstream from all known point sources of water pollution, and they were also assumed to be relatively unimpacted by nonpoint sources. The decision of which reference station to use for comparison to a study site was primarily based on comparability of ambient water temperature, stream morphology, flow regimes, and drainage area. Hawes Brook was designated the warm-water reference station and Traphole Brook was designated the cold-water reference station. Both streams served as reference stations during DEP's 1994 biomonitoring survey in the Neponset River sub-basin.

During "year 1" of its 5-year basin cycle, problem areas within the Boston Harbor watershed were better defined through such processes as coordination with appropriate groups (EOEA Basin Teams, EPA, watershed associations, USGS), assessing existing data, conducting site visits, and reviewing NPDES and water withdrawal permits. Following these activities, the 1999 biomonitoring plan was more closely focused and the study objectives better defined. Table 2 includes a summary of the perceived problems/issues—both historical and current—addressed during the 1999 Boston Harbor watershed biomonitoring survey.

The main objectives of biomonitoring in the Boston Harbor watershed were: (a) to determine the biological health of streams within the watershed by conducting assessments based on aquatic macroinvertebrate communities; and (b) to identify problem stream segments so that efforts can be focused on developing NPDES permits, Water Management Act permits, stormwater management, and control of other nonpoint source (NPS) pollution. Specific tasks were:

4. Conduct benthic macroinvertebrate sampling at locations throughout the Boston Harbor watershed.
5. Based upon the macroinvertebrate data, identify river segments within the watershed with potential point/nonpoint source pollution problems; and
6. Using the benthic macroinvertebrate data and supporting water chemistry and field data, assess the types of water quality and/or water quantity problems that are present, and if possible, make recommendations for remedial actions. Provide macroinvertebrate data to DWM's Environmental Monitoring and Assessment Program to be used in making aquatic life use assessments required by Section 305b of the Clean Water Act.

Table 1. List of macroinvertebrate biomonitoring stations sampled during the 1999 Boston Harbor watershed surveys, including station identification number, station description, and sampling date.

Station	Drainage Area (mi^2)	**BOSTON HARBOR WATERSHED** Site description	Sampling Date
73-9BOB	4.41	Massapoag Brook, downstream from Manns Pond, Sharon, MA	6 July 1999
73-NE09	8.61	Hawes Brook, downstream from Route 1A (Washington St.), Norwood, MA	6 July 1999
73-MB01	2.36	Mill Brook, downstream from Millbrook Road, Medfield, MA	6 July 1999
73-5B01	2.66	Traphole Brook, downstream from Coney Street, Walpole, MA	6 July 1999
73-SB01	5.00	Unnamed tributary to Steep Hill Brook, downstream from Central Street, Stoughton, MA	7 July 1999
73-BM01	2.82	Beaver Meadow Brook, downstream from Pine Street, Canton MA	7 July 1999
73-BB01	2.46	Beaver Brook, downstream from Maskwonicut Street, Sharon, MA	7 July 1999
73-NE12	28.15	East Branch Neponset River, downstream from Neponset Street, Canton, MA	7 July 1999
73-PB01	6.39	Pequit Brook, upstream from Sherman Street, Canton, MA	8 July 1999
74-MR01	27.64	Monatiquot River, downstream from Middle Street, Braintree, MA	8 July 1999
74-SR01	4.39	Old Swamp River, upstream from Route 3N, Weymouth, MA	8 July 1999
74-WR01	14.57	Weir River, upstream from Route 228, Hingham, MA	8 July 1999
71-AR01	24.83	Aberjona River, downstream from USGS gage, Winchester, MA	9 July 1999
71-MI01	4.96	Mill Brook, upstream from Mill Street, Arlington, MA	9 July 1999

Table 2. List of perceived problems addressed during the 1999 Boston Harbor watershed macroinvertebrate biomonitoring survey. Specific biomonitoring stations addressing each problem are also listed.

Issues/Problems	**BOSTON HARBOR WATERSHED** Neponset River Sub-basin
Groundwater withdrawals/reduced flows	73-9B0B; 73-5B01; 73-SB01; 73-BB01; 73-NE12; 73-BM01; 73-PB01; 73-MB01
NPS (trash, habitat degradation, road runoff, unknown)	73-9B0B; 73-NE09; 73-5B01; 73-SB01; 73-BB01; 73-NE12; 73-BM01; 73-PB01; 73-MB01
Issues/Problems	**BOSTON HARBOR WATERSHED** Mystic River Sub-basin
Urban runoff (including stormwater), CSOs, illicit stormdrain/sewer connections, low DO, pathogens	71-AR01; 71-MI01
Issues/Problems	**BOSTON HARBOR WATERSHED** Weymouth/Weir River Sub-basin
Groundwater withdrawals/reduced flows	74-WR01; 74-SR01
Sewer overflows, road runoff, failing septic systems	74-SR01
Miscellaneous NPS (habitat degradation, stormwater/road runoff, trash)	74-MR01

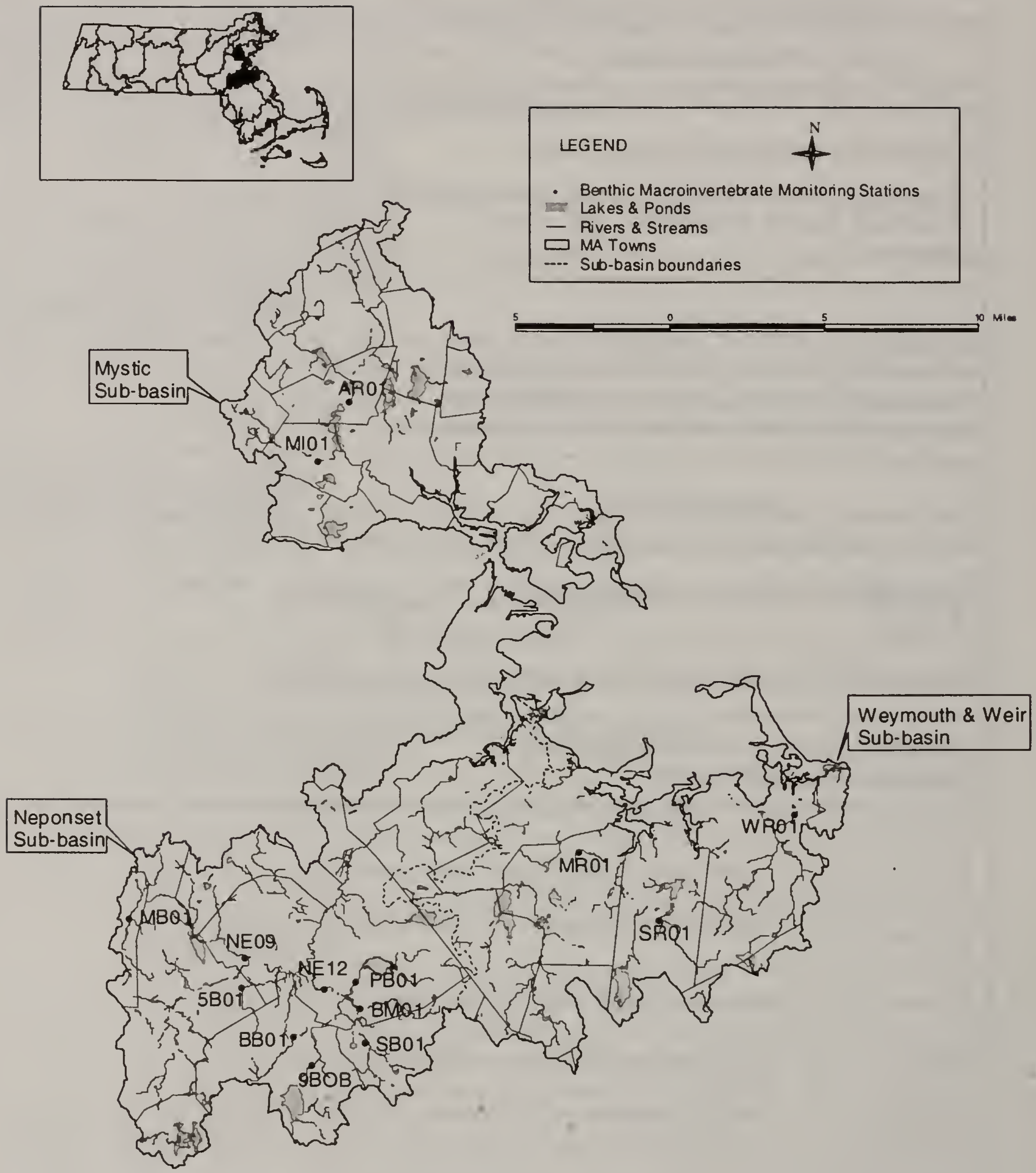

Figure 1. Locations of DEP biomonitoring stations sampled during the 1999 Boston Harbor watershed survey.

METHODS

MACROINVERTEBRATE SAMPLING

The macroinvertebrate sampling and processing procedures are described in the *Water Quality Monitoring In Streams Using Aquatic Macroinvertebrates* standard operating procedures (Nuzzo 1999), and are based on USEPA Rapid Bioassessment Protocols (RBPs) (Barbour et al. 1999). Sampling was conducted throughout a 100 m reach, in riffle/run areas with fast currents and cobble/gravel substrates—generally the most productive habitats, supporting the most diverse communities in the stream system. Ten kicks in squares approximately 0.46 m x 0.46 m were composited for a total sample area of about 2 m^2. Samples were preserved in the field with denatured 95% ethanol, then brought to the DEP/DWM lab for processing.

HABITAT ASSESSMENTS

An evaluation of physical and biological habitat quality is critical to any assessment of ecological integrity (Karr et al. 1986; Barbour et al. 1999). Habitat assessment supports understanding of the relationship between physical habitat quality and biological conditions, identifies obvious constraints on the attainable potential of a site, assists in the selection of appropriate sampling stations, and provides basic information for interpreting biosurvey results (US EPA 1995). Before leaving the sample reach, habitat qualities were scored using a modification of the evaluation procedure in Barbour et al. (1999). The matrix used to assess habitat quality is based on key physical characteristics of the water body and surrounding land use. Most parameters evaluated are instream physical attributes often related to overall land use and are potential sources of limitation to the aquatic biota (Barbour et al. 1999). The ten habitat parameters are as follows: instream cover, epifaunal substrate, embeddedness, sediment deposition, velocity/depth combinations, channel flow status, right and left (when facing downstream) bank vegetative protection, right and left bank stability, right and left bank riparian vegetative zone width. Habitat parameters are scored, totaled, and compared to a regional reference station and/or a site-specific control (upstream reference) station to provide a final habitat ranking.

MACROINVERTEBRATE SAMPLE PROCESSING AND ANALYSIS

Macroinvertebrate sample processing entailed distributing a sample in pans, selecting grids within the pans at random, and sorting specimens from the other materials in the sample until approximately 100 organisms (±10%) were extracted. Specimens were identified to genus or species as allowed by available keys, specimen condition, and specimen maturity. Taxonomic data were analyzed using a modification of Rapid Bioassessment Protocol III (RBP III) metrics and scores (Barbour et al. 1999). Based on the taxonomy various community, population, and functional parameters, or “metrics,” were calculated which allow an investigator to measure important aspects of the biological integrity of the community. This integrated approach provides more assurance of a valid assessment because a variety of biological parameters are evaluated. Deficiency of any one metric should not invalidate the entire approach (Barbour et al. 1999). Metric values for each station were scored based on comparability to the reference station, and scores were totaled. The percent comparability of total metric scores for each study site to those for a selected “least-impacted” reference station (i.e., “best attainable” situation) yields an impairment score for each site. RBP III analysis separates sites into four categories: non-impacted, slightly impacted, moderately impacted, and severely impacted. Impacts to the benthic community may be indicated by the absence of generally pollution-sensitive macroinvertebrate taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT); dominance of a particular taxon, especially the pollution-tolerant Chironomidae and Oligochaeta taxa; low taxa richness; or shifts in community composition relative to the reference station (Barbour et al. 1999). Those biological metrics calculated and used in the analysis of Boston Harbor watershed macroinvertebrate data are listed and defined below. For a more detailed description of metrics used to evaluate benthos data see Barbour et al. (1999):

1. Taxa richness—a measure based on the number of taxa present. The lowest possible taxonomic level is assumed to be genus or species.

2. EPT Index—a count of the number of genera/species from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). As a group these are considered three of the more sensitive aquatic insect orders. Therefore, the greater the contribution to total richness from these three orders, the healthier the community.

3. Biotic Index—based on the Hilsenhoff Biotic Index (HBI), this is an index designed to produce a numerical value to indicate the level of organic pollution. Organisms have been assigned a value ranging from zero to ten based on their tolerance to organic pollution. A value of zero indicates the taxon is highly intolerant of pollution and is likely to be found only in pollution-free waters. A value of ten indicates the taxon is tolerant of pollution and may be found in highly polluted waters. The number of organisms and the individually assigned values are used in a mathematical formula that describes the degree of organic pollution at the study site. The formula for calculating HBI is:

$$\mathrm{HBI} = \sum \frac{x_i t_i}{n}$$

where

x_i = number of individuals within a taxon

t_i = tolerance value of a taxon

n = total number of organisms in the sample

4. Ratio of EPT and Chironomidae Abundance—The EPT and Chironomidae abundance ratio uses relative abundance of these indicator groups as a measure of community balance. Skewed populations having a disproportionate number of the generally tolerant Chironomidae ("midges") relative to the more sensitive insect groups may indicate environmental stress.

5. Percent Contribution Dominant Taxon—is the percent contribution of the numerically dominant taxon (genus or species) to the total numbers of organisms. A community dominated by few species indicates environmental stress. Conversely, more balance among species indicates a healthier community.

6. Ratio of Scraper and Filtering Collector Functional Feeding Groups—this ratio reflects the community food base. The proportion of the two feeding groups is important because predominance of a particular feeding type may indicate an unbalanced community responding to an overabundance of a particular food source (Barbour et al. 1999). Scrapers predominate when diatoms are the dominant food resource, and decrease in abundance when filamentous algae and mosses prevail. Filtering collectors thrive where filamentous algae and mosses are prevalent and where fine particulate organic matter (FPOM) levels are high.

FISH POPULATION SAMPLING

Fish population data were collected from selected Neponset River sub-basin stations to supplement the macroinvertebrate biomonitoring data. Collection methods used to assess fish populations were in accordance with the *Preliminary Biological Monitoring and Assessment Protocols for Wadeable Rivers and Streams* (Tetra Tech, Inc. 1995), and followed essentially a modified version of RBP Protocol V (Barbour et al. 1999). Fish community sampling was conducted at each tributary station between 27 and 29 July 1999 by DWM using a battery-powered backpack electroshocking unit (Smith-Root™ Model 12).

One pass was made in a representative stream reach (containing riffle, run, and pool habitat when available) measuring approximately 100 meters. Fish sampling commenced at the downstream riffle or other barrier (e.g., seine net, culvert, etc.) and proceeded upstream in side-to-side sweeps. Sampling was terminated at a constriction or other barrier to migration (such as a net) at the upstream end of the reach. Attempts were made to pick up all fish observed. All fish collected were held in plastic buckets for identification, enumeration, and subsequent release. Also noted and recorded on field sheets were general conditions of fish, including the presence of anomalies such as deformities, eroded fins, fungus, lesions, emaciation, and tumors. Voucher specimens were retained and preserved for later verification if field identifications were questionable.

FISH POPULATION ANALYSIS

The RBP V protocol (Barbour et al. 1999) calls for the analysis of the data generated from fish collections using an established Index of Biotic Integrity (IBI) similar to that described by Karr et al. (1986). Since no formal IBI exists for Massachusetts surface waters, the data provided by this sampling effort were used to assess the general condition of the resident fish population as a function of abundance and diversity.

RESULTS AND DISCUSSION

The taxonomic list of macroinvertebrates collected at each sampling station is attached as an appendix (Table A1). Included in the taxa list are total organism counts, and the functional feeding group (FFG) and tolerance value (TV) of each taxon.

Summary tables of the RBP III data analyses, including biological metric calculations, metric scores, and impairment scores, are included in the Appendix as well. Table A2 is the summary table for all warm-water Neponset River sub-basin stations using NE09 as the regional reference station. Table A3 is the summary table for those Neponset River sub-basin stations that require a cold-water reference site, using 5BOB as the regional reference station. Tables A4 and A5 summarize comparisons of the NE09 benthos to stations in the Mystic River sub-basin and Weymouth/Weir River sub-basin respectively. Habitat assessment scores for each station are also included in the summary tables, while a more detailed summary of habitat parameters is shown in Table A6. Finally, the appendix includes the taxa list for fish collected in the Neponset River sub-basin biomonitoring stations (Table A7).

The 1999 biomonitoring data for this watershed generally indicate nonpoint source-related problems in most of the tributary streams examined. Various forms of urban runoff, coupled with habitat degradation, compromise water quality and biological integrity in the Mystic River sub-basin. Habitat constraints and/or miscellaneous NPS pollution impair aquatic life in the Neponset River and Weymouth/Weir River sub-basins. In addition, several streams examined in the Neponset River sub-basin remain relatively non-impacted and are indicative of the “best attainable” conditions in the watershed.

Neponset River Sub-basin

The Neponset River sub-basin is located in eastern Massachusetts, within the metropolitan Boston area. The basin encompasses portions of Boston, Quincy, Milton, Dedham, Westwood, Dover, Medfield, Walpole, Foxborough, Sharon, Stoughton, and Randolph, while the entire towns of Canton and Norwood are located within its boundaries. From the outlet of the Neponset Reservoir to its mouth in Dorchester Bay the Neponset River falls approximately 270 feet in elevation. The Neponset River is 29.5 miles in length and drains 117 square miles. The river is impounded by 12 dams and passes through several mills and private reservoirs.

Boston, Quincy, Dedham and Milton comprise the lower basin. These communities are primarily urbanized and contain a wide variety of industrial, commercial and service-oriented interests. The middle portion of the basin—Westwood, Norwood and Canton—has a variety of industry. Development in Westwood and Norwood is heavy along Routes 1 and 1A, including both manufacturing and wholesale/retail trade. There is a concentration of industrial/commercial usage in Canton along Route 138 and the East Branch Neponset River. The Stoughton/Randolph drainage areas are comprised of residential and commercial development. Most of the industrial development in the upper watershed is in Walpole, concentrated along the Routes 1-1A corridor. The area of Foxborough located within the watershed is primarily residential, as are the other towns in the basin—Dover, Medfield and Sharon.

Hawes Brook

The Hawes Brook subwatershed consists of Bubbling and Mill brooks and several unnamed tributaries to Pettee and Willet ponds, as well as Germany Brook which flows into Ellis Pond. Hawes Brook is the named stream from the outlet of Ellis Pond to its confluence with the Neponset River in Norwood. The Hawes Brook system drains portions of Dover, Westwood, and Walpole and is dominated by residential, recreational, and commercial land use.

NE09—Hawes Brook, mile point 0.2, downstream from Washington Street, Norwood, MA

Habitat

The NE09 sampling reach began approximately 150 m downstream from Washington Street, in a residential area of Norwood. This station was chosen as the warm-water reference station because the habitat quality was considered good with respect to stability and composition of instream substrates. Indeed, well-developed riffle and run areas dominated the reach, and an abundance of cobble provided excellent epifaunal habitat for macroinvertebrates. Instream cover for fish was less than optimal, primarily due to a lack of deep-water areas and habitat variety. In fact, much of the instream fish cover present existed in the form of trash—scrap metal, cans, plastics, and other debris. Instream vegetation consisted of rooted submergent macrophytes (*Potamogeton crispus*) midreach and filamentous algae at the lower end of the reach where the mostly shaded sampling area gave way to a partially open canopy. Both stream banks were fairly well-vegetated and stable, with “rip-rap” and concrete block walls providing additional bank reinforcement at the top and bottom of the reach respectively. Some streambank erosion and associated runoff originating from an adjacent restaurant parking lot were observed along the right (south) bank near the top of the reach. Other forms of nonpoint source pollution existed primarily in the form of lawn runoff, yard waste, and trash—all associated with the numerous adjacent residences located throughout the sampling reach. NPS pollution may be exacerbated by the extremely narrow riparian buffer—mainly comprised of a thin strip of red maple (*Acer rubrum*) and slippery elm (*Ulmus rubra*)—between the stream channel and the abutting yards. NE09 received a total habitat assessment score of 131/200 (Table A6).

Benthos

As with the 1994 bioassessment conducted here, this reach of the stream was characterized by a macroinvertebrate assemblage indicating a healthy aquatic community. A richness of 7 intolerant EPT taxa was recorded—the most of any biomonitoring station in the basin—and most of the metric values were indicative of clean water and “least-impacted” conditions (Table A2). In particular, those attributes that measure components of community structure (i.e., taxa richness, biotic index, EPT index)—which display the lowest inherent variability among the RBP metrics used (Resh 1988)—scored well, further corroborating the designation as a reference station. A biotic index of 4.93 was low relative to many of the biomonitoring stations in the survey, indicating the dominance of the Hawes Brook benthos assemblage by pollution-sensitive taxa. NE09 received a total metric score of 34/36 (Table A2).

Fish

Fish sampling at NE09 resulted in the collection of fallfish (*Semotilus corporalis*), American eel (*Anguilla rostrata*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and white sucker (*Catostomus commersoni*) (Table A7). The fish assemblage was dominated by pond species which are most likely emigrating from the many impoundments located upstream. The presence of impoundments both upstream and downstream of the sampling reach, and the rather limited total length of true lotic habitat in general, make restoration of a stream fish assemblage problematic.

Traphole Brook

The Traphole Brook subwatershed drains portions of Sharon, Walpole, and Norwood. The mostly forested upper portion of the subwatershed gives way to residential and commercial land use as the stream heads in a northeasterly direction towards its confluence with the Neponset River in Sharon. Two highways—Interstate 95 and Route 1—intersect Traphole Brook approximately midbasin. This tributary supports a self-sustaining cold-watery fishery, and the water temperature was the coolest documented in the basin. Findings from DEP's 1994 Neponset River Watershed Resource Assessment Report indicated that septic system failure may compromise water quality in some portions of this stream (MA DEP 1995).

5B01—Traphole Brook, mile point 1.7, downstream from Coney Street, Walpole, MA

Habitat

The 5B01 sampling reach began approximately 200 m downstream from Coney Street, in a densely forested portion of the subwatershed. Hardwoods were predominant throughout most of the reach, save for some overhanging shrubs (*Viburnum* sp.) and jewelweed (*Impatiens capensis*) along the lower half. Cool, clear riffles dominated the reach, and along with an abundance of rocky substrates offered excellent instream habitat for macroinvertebrates. Fish cover was good, with snags, boulders, and overhanging vegetation providing much of the stable habitat; however, pool areas were somewhat limited. With the exception of filamentous green algal mats near the bottom of the sampling reach and occasional patches of moss, instream vegetation was virtually absent. Both stream banks were well-vegetated and stable, and the extensive maple-dominated (*Acer rubrum*) riparian zone was only minimally disturbed. An adjacent yard near the bottom of the reach was a potential source of NPS pollution (e.g., grass clippings and other yard waste/runoff) but was fairly well-buffered from the stream by shrubs and other vegetation. The Coney Street crossing just upstream was a potential source of NPS inputs; however, no signs of runoff (e.g., instream sedimentation) were observed during sampling. 5B01 received a total habitat assessment score of 168/200 (Table A6).

Benthos

The benthic community encountered at 5B01 reflected the excellent habitat available in this portion of Traphole Brook. A diverse assemblage of clean-water taxa dominated the sample, including three species of stoneflies (Plecoptera), generally considered the most pollution-sensitive insect order. In addition to numerous intolerant EPT taxa, the elmid beetles—a relatively intolerant insect family whose plastron respiration requires well-oxygenated instream conditions (Peckarsky et al. 1990)—were well represented in the 5B01 sample as well (Table A1). A biotic index of 2.67 was quite low relative to the other biomonitoring stations in the survey, indicating the dominance of the Traphole Brook benthos assemblage by highly pollution-sensitive taxa. 5B01 received a total metric score of 32/36 (Table A3). The balanced trophic structure and optimum community structure (composition and dominance) found at 5B01 corroborate its use as a regional reference station (cold-water). Biological integrity appears to have remained optimal here since the last DEP biological survey conducted in 1994, when a diverse macroinvertebrate community dominated by intolerant taxa was documented (MA DEP 1995).

Fish

A total of 76 fish were collected in the 5B01 sampling reach. The sample included 29 brown trout (*Salmo trutta*) and 47 brook trout (*Salvelinus fontinalis*)—generally considered the most pollution-sensitive species found in lotic waters (Table A7). While some of the fish collected appeared to be stocked (as evidenced by size and/or fin quality) the majority of fish appeared to be part of reproducing populations of both brown and brook trout. There were many age classes present, including a large number of young-of-the-year (0+). It appeared that most, if not all, available high quality fish habitat was being utilized.

Spawning habitat for brook and brown trout normally consists of gravelly shallows, especially in areas with upwellings of springwater. As such, sedimentation (resulting from road crossings, construction sites, streambank alteration, etc) can be detrimental to trout spawning habitat and should be minimized. Efforts to protect flow and habitat quality will be key in maintaining this unique brook and brown trout assemblage. The presence of high quality trout habitat is relatively rare in the eastern part of the Commonwealth making Traphole Brook a valuable resource with regard to overall biological diversity within the Neponset River sub-basin.

Massapoag Brook

From its headwaters in Massapoag Lake—the largest lake in the Neponset River sub-basin—Massapoag Brook flows through several small impoundments along its course to Forge Pond in Canton. The majority of this subwatershed lies in Sharon, which is served entirely by on-site septic systems. Municipal (Town of Sharon) groundwater wells abutting Massapoag Lake have historically resulted in reduced water levels in the lake and reductions in outflow from the lake (NepRWA 1998). Flow regulation at the Massapoag Lake outlet and further downstream at Manns Pond, and its effect on downstream flows and resident biota, is an ongoing concern in this subwatershed.

9BOB—Massapoag Brook, mile point 3.9, downstream from Manns Pond, Sharon, MA

Habitat

The 9BOB sampling reach began approximately 100 m downstream from Manns Pond and terminated immediately below the pond outlet. The steep gradient of this portion of the stream provided numerous riffle areas of varying depths, and along with abundant cobble/boulder substrates, afforded macroinvertebrates with excellent epifaunal habitat. Instream root masses and aquatic mosses provided additional benthic microhabitat. Fish habitat was excellent as well, with numerous pools and a variety of stable habitat (e.g., snags, submerged logs, undercut banks) providing ample cover. Both stream banks were well-vegetated, while boulders and root masses provided good stability. A forested riparian zone consisting of mainly red maple (*Acer rubrum*) and fern understory extended undisturbed from the left (south) bank and provided adequate buffer from an adjacent road (Billings Street) near the right (north) bank. 9BOB received a total habitat assessment score of 183/200—the highest score received by a biomonitoring station in the 1999 Boston Harbor watershed survey (Table A6).

Benthos

Despite the excellent habitat available the 9BOB benthos assemblage received a total metric score of only 20, representing 59% comparability to the warm-water reference station at NE09 and resulting in "slightly impacted" biological status (Table A2). The dominance of the community by relatively few taxa, particularly the filter-feeding caddisflies (filter-feeding sponges were extremely abundant as well, but not included in the sample) Hydropsychidae and Philopotamidae indicates an unbalanced community responding to an overabundance of fine particulate organic matter (FPOM) in the water column. Significant deposits of FPOM were also observed on much of the instream substrates. That the assemblage is dominated by filter-feeders is not surprising, as upstream impoundments are no doubt a contributing source of suspended FPOM; however, the high densities represented by these taxa are somewhat disconcerting and indicative of the effects of moderate enrichment. Typically, in lentic systems such as the impoundments upstream, the primary source of organic matter is autochthonous (produced within the system), with secondary inputs of allochthonous (transported into the system from someplace else) materials from shoreline vegetation and fluvial inputs (Wetzel 1975, Merritt et al. 1984). Phytoplankton production—and to a lesser extent, littoral vascular plant production—and associated dissolved organic matter (DOM), are the primary source of autochthonous matter (Wetzel 1975). It is the physical-chemical flocculation (nonbiological) of this DOM and/or other biological processes that leads to the formation of FPOM, the primary nutrition resource utilized by filter-feeders (Wetzel 1975). While FPOM production in lotic systems is primarily a result of the processing of Course Particulate Organic Material (CPOM) contributed by aquatic shredders, the high concentration of FPOM in stream systems immediately below pond and reservoir outlets has mainly lentic origins. If these lentic systems are subjected to increasingly eutrophic conditions the resulting effects of enrichment (i.e., increased algal, plant, and DOM production) can be seen not only in the lentic fauna, but also in the lotic aquatic communities immediately downstream.

The enrichment effects (e.g., dominance of filter-feeders, reduced EPT index) reflected in the 9BOB benthic community are probably most directly related to the productive nature of Manns Pond immediately upstream. Trophic status for this impoundment was determined to be eutrophic during the 1994 lake assessments conducted by MA DEP (1995). As with the 1994 survey of Manns Pond, dense cover by non-native macrophytes was observed during the time of the 1999 biosurvey at 9BOB. Nutrient/organic loadings originating from inadequate septic systems, or miscellaneous forms of urban runoff, probably contribute to the productive conditions that supply an abundant FPOM food resource to the downstream aquatic community.

Fish

Fish sampling at 9BOB found an assemblage dominated by “pond” species, further corroborating the influence that the upstream impoundment has on aquatic community structure in this portion of Massapoag Brook. Brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*Lepomis gibbosus*) made up 80 percent of the fish collected at this location. In addition, largemouth bass (*Micropterus salmoides*) and golden shiner (*Notemigonus crysoleucas*) were also part of the sample. Two white sucker (*Catostomus commersoni*) and three American eel (*Anguilla rostrata*) were collected as well (Table A7).

The presence of Manns Pond located just upstream from the study reach is clearly having an impact on the fish assemblage at this station. The majority of the pond fishes present appeared to be 2-year olds which most likely emigrated from the pond during high flows. The physical habitat within the reach does not support stable populations of pond fishes (i.e., reproducing populations represented by multiple age classes). The absence of “stream” species may be due to direct competition with the fish coming out of pond and/or periodic low-flow events and insufficient re-population from downstream areas. The restoration and maintenance of a more typical stream fish assemblage in this reach may be problematic due to the presence of the pond and the potential for periodic flow interruption. Efforts to restore a stream fish assemblage by maintaining minimum baseflow in this reach may be unrealistic or ineffective due to competition from pond species emigrating from Manns Pond.

Beaver Brook

From its headwaters in Sharon, Beaver Brook drains an area of mostly forest, wetland, and other open space as it flows in a northeasterly direction towards its confluence with Massapoag Brook. Despite the relatively undeveloped nature of this small subwatershed, the presence of three groundwater wells adjacent to Beaver Brook may have pronounced effects on instream baseflow and biological potential.

BB01—Beaver Brook, mile point 0.75, downstream from Maskwonicut Street, Sharon, MA

Habitat

The mostly shaded BB01 sampling reach began approximately 300 m downstream from Maskwonicut Street in a forested portion of the watershed. Though relatively shallow, the riffle-dominated reach offered excellent habitat for macroinvertebrates. Cobble and gravel substrates were prevalent throughout this portion of the stream, and along with dense instream moss cover, provided optimal epifaunal substrates for benthic organisms. Fish habitat was also good, with undercut banks, snags, and boulders providing ample instream cover. Occasional patches of the rooted submergent macrophyte, water starwort (*Callitriche* sp.), probably offered additional microhabitat for fish and invertebrates as well. Both steam banks were well-vegetated and stabilized by boulders and root masses. The maple (*Acer rubrum*) dominated riparian zone was extensive along both stream banks in the sampling reach, although upstream from the reach the riparian buffer between the right (east) bank and an adjacent railroad track was minimal. In addition to the nearby railroad tracks, a road crossing (Maskwonicut Street) just upstream from the sampling reach was a potential source of NPS pollution inputs. BB01 received a total habitat assessment score of 179/200 (Table A6).

Benthos

The benthos assemblage at BB01 received a total metric score of 28, representing 82% comparability to the warm-water reference community at NE09 and resulting in an aquatic assessment of "non/slightly impacted" (Table A2). The fact that the biotic index was actually lower (4.35) than at NE09, and the taxa richness (32) was the highest of all the Boston Harbor watershed biomonitoring stations, suggests good biological diversity at BB01 and a community dominated by pollution-sensitive forms. Only the EPT/Chironomidae metric scored poorly—the result of a relatively high abundance of midges compared to reference conditions. That the Chironomidae dominate the BB01 assemblage may be significant, since several of the midges present are considered tolerant of low-flow conditions (Bode, NY DEC, personal communication).

When using the cold-water community at 5B01 as the reference station, BB01 received a total metric score of 24, representing 75% comparability to the "best attainable" conditions of Traphole Brook (Table A3). Despite the resulting "slightly impacted" assessment, several of the metrics for the BB01 assemblage scored better than, or as well as, the reference station—most notably, the taxa richness and EPT index metrics (Table A3). The apparent discrepancy in community structure between BB01 and 5B01 may in fact be the result of differing physico-chemical conditions (e.g., ambient water temperature, baseflow)—be they naturally-occurring or anthropogenically induced—rather than water quality effects at BB01.

Fish

The fish community at the Beaver Brook sampling location contained a total of four fish. The sample included one brown trout (*Salmo trutta*), one white sucker (*Catostomus commersoni*), one largemouth bass (*Micropterus salmoides*), and one redfin pickerel (*Esox americanus americanus*) (Table A7). The low fish abundance was surprising, as this segment contained a diverse mix of pool, riffle, and run/glide habitat containing excellent fish cover in the form of snags, undercut banks, and boulders. The occurrence—albeit infrequent—of salmonids at BB01 suggests this stream can support a cold-water biological community, corroborating the use of 5B01 as the primary macroinvertebrate reference station for the BB01 benthic community.

It is unclear as to why fish were largely absent from the BB01 stream reach. Interestingly, species which are representative of a wide range of tolerances to both dissolved oxygen and temperature were found. It is possible that episodic low-flow events may be responsible for the absence of fish due to "de-watering" of habitat. Water quality data—if available—should also be examined to determine if low pH or dissolved oxygen might be contributing to the low fish abundance. This station is a good candidate for additional fish community assessment in the future.

Beaver Meadow Brook

From its source in Glen Echo Pond in Stoughton/Canton, Beaver Meadow Brook flows in a westerly direction to Bolivar Pond in Canton. The subwatershed drains mostly wetland, open space, and light to moderately developed residential portions of Canton. Several groundwater withdrawals exist along Beaver Meadow Brook, and an additional well is proposed near Route 138.

BM01—Beaver Meadow Brook, mile point 0.20, downstream from Pine Street, Canton, MA

Habitat

The BM01 sampling reach began approximately 300 m upstream from Bolivar Pond, in a forested portion of the watershed. While reduced baseflow during spring reconnaissance of this stream resulted in mostly exposed substrates and less than optimal sampling conditions, water levels had improved dramatically when DWM returned to sample the stream during the July macroinvertebrate survey. Snags, undercut banks, and rocky substrates that were exposed just a few weeks earlier were subjected to a variety of flow regimes during the time of the biosurvey, resulting in excellent fish and macroinvertebrate habitat. Riparian vegetation was undisturbed and dominated by hardwoods, most notably red maple (*Acer rubrum*), ash (*Fraxinus americana*), and hop hornbeam (*Ostrya virginiana*). Herbaceous growth was observed in the understory and along the stream banks, consisting of poison ivy (*Rhus radicans*), rose (*Rosa* sp.), greenbrier (*Smilax rotundifolia*), ferns, and jewelweed (*Impatiens capensis*). In addition to herbaceous growth, stream banks were stabilized by boulders and large root masses. Instream aquatic vegetation and algae were not observed; however, instream turbidity made it difficult to see submerged vegetation. NPS pollution existed in the form of instream trash, with runoff from a nearby apartment complex posing a threat as well. BM01 received a total habitat assessment score of 176/200 (Table A6).

Benthos

Based on ambient water temperature and the fish assemblage present at BM01, it was determined that the warm-water reference station NE09 should serve as the primary reference station for the BM01 benthos community. The BM01 macroinvertebrate assemblage received a total metric score of 30, representing 88% comparability to NE09 and resulting in a “non-impacted” assessment for biological condition (Table A2). Community composition metrics scored well relative to reference conditions, with good representation of pollution-sensitive taxa.

Even when using the cold-water station at Traphole Brook as a reference station, taxa richness and EPT richness at BM01 were comparable to “least impacted” conditions (Table A3). Community structure differed from the 5B01 reference station, however—largely the result of dissimilar trophic structure. Trophic structure at BM01 was skewed towards the filter-feeders, as indicated by the hyperdominance of hydropsychid and philopotamid caddisflies (Table A1). When compared to the cold-water reference station, the BM01 benthic community received a total metric score of 20, representing 63% comparability and placing the assemblage in the “slightly impacted” category (Table A3).

Upstream impoundments no doubt are a contributing source of FPOM to the BM01 macroinvertebrate community, and probably have a more significant influence on community structure than do fluctuating baseflow levels in this portion of Beaver Meadow Brook. It is unclear the extent to which current water quality conditions in the upstream impoundments are affecting instream turbidity at BM01; however, other potential sources (e.g., runoff from nearby roads, parking lots, and numerous gravel pits) no doubt exist in this subwatershed.

Fish

Fish species present in order of abundance included brown bullhead (*Ameiurus nebulosis*), white sucker (*Catostomus commersoni*), largemouth bass (*Micropterus salmoides*), American eel (*Anguilla rostrata*), pumpkinseed (*Lepomis gibbosus*), darter (*Etheostoma olmstedi*), yellow perch (*Perca flavescens*), redfin pickerel (*Esox americanus*), and golden shiner (*Notemigomus crysoleucas*) (Table A7). The majority of the fish (91%) were young-of-the-year brown bullhead (n=72), white sucker (n=15), and largemouth bass (n=8). It is possible that the slightly turbid conditions of this stream precluded the efficient collection of darters, as they can be difficult to see even under the best conditions. The presence of impoundments both upstream and downstream of this location is almost certainly having an effect on fish community composition in this portion of Beaver Meadow Brook.

Mill Brook

Comprised of Tubwreck, Mill and Mine brooks, this small subwatershed contains numerous municipal water supply wells in the towns of Dover, Medfield and Walpole. The total withdrawal from the subwatershed was 1.4 million gallons per day (MGD) in 1994. The only discharge to the sub-basin, other than the return of wastewater through a small number of septic systems, is the filter backwash water from the Harold E. Willis Water Treatment Plant in Walpole, which discharges into a wetland area adjacent to

Mine Brook. The Mill Brook subwatershed is experiencing considerable development in the form of single family home subdivisions. Stormwater controls to prevent construction impacts such as erosion and sedimentation from subdivisions in Medfield were found by DEP to be improperly installed and presumed ineffective (MA DEP 1995). While documented as supporting a cold-water fishery as recently as 1987 (based upon the records of the DFWELE), no salmonids (i.e., trout) were found during DEP/DWM's 1994 biological monitoring effort in Mill Brook. Furthermore, the water temperature was higher than expected (26°C).

After receiving the discharge from the headwater stream of Tubwreck Brook, Mill Brook flows in a southerly direction through areas of extensive wetlands, forest, and light residential development before entering Jewells Pond in Medfield. From this small impoundment the stream—now Mine Brook—continues in a southerly direction until it joins the Neponset River just downstream from Turner Pond in Walpole.

MB01—Mill Brook, mile point 5.90, downstream from Millbrook Road, Medfield, MA

Habitat

The MB01 sampling reach began approximately 100 m downstream from Millbrook Road and ended at the road crossing. The shaded reach meandered through a mostly deciduous forest, dominated by red maple (*Acer rubrum*), red oak (*Quercus rubra*), and ash (*Fraxinus americana*). A shrubby understory of sweet pepperbush (*Clethra alnifolia*) and azalea was also present. Rocky substrates consisting of cobble, pebble, and gravel were common throughout much of the reach; however, extremely low baseflow resulted in much exposed benthos habitat. In fact, it was estimated that only about 50% of the stream channel contained water despite the heavy rain received during the previous week. The shallow nature of those riffle, run, and pool areas present resulted in less than optimal epifaunal habitat for macroinvertebrates and poor instream fish cover. Instream vegetation existed mainly as moss, with some macrophytes (*Lemna* sp., *Callitriche* sp.) present as well. Filamentous green algae covered < 5% of the sampling reach. There was some evidence of sediment deposition, with the Millbrook Road crossing the most likely source of NPS inputs. Stream bank and riparian habitat parameters rated excellent, especially along the right (west) bank where the vegetative buffer extended undisturbed. The left (east) bank was well-vegetated and stable as well, although some understory vegetation appeared to be removed as part of the landscaping efforts of an adjacent home. The MB01 station received a total habitat assessment score of 143/200 (Table A6).

Benthos

The MB01 macroinvertebrate community received a total metric score of 26 when compared to the Hawes Brook reference station. This represents 76% comparability to the warm-water reference condition, placing the MB01 benthos assemblage in the "slightly impacted" category (Table A2). However, the presence of trout (as discussed below) during the 1999 biosurvey here suggests that comparisons to the cold-water reference station of 5B01 may be more appropriate. That said, MB01 received a total metric score of 20, representing only 63% comparability to "best attainable" conditions when using the Traphole Brook station as the reference. The resulting assessment places MB01 in the "slightly impacted" category for biological condition (Table A3).

Regardless of which reference station is used, it appears that habitat is almost certainly limiting to biological potential at MB01. Instream habitat constraints related to reduced baseflow, in particular, appear to compromise biological integrity in this portion of Mill Brook. Interestingly, taxa richness at MB01 is higher than both reference station assemblages; however, it is the diversity of chironomids rather than more intolerant taxa that contributes most to the high richness seen in the MB01 community. In fact, the Chironomidae comprise more than 60% of the MB01 assemblage, contributing to an EPT/Chironomidae metric value that is by far the lowest of all the Neponset River sub-basin biomonitoring stations (Table A2 and A3). Of further note is the fact that many of the Chironomidae present in the MB01 assemblage—including the dominant taxon, *Micropsectra* sp.—may display low-flow adaptations, having been observed in high densities in other northeastern streams subjected to flow constraints (Fiorentino 2000; Fiorentino 1999; Bode, NY DEC, personal communication).

Fish

Electroshocking efficiency was rated excellent. Contrary to the findings of DEP's 1994 fish survey of this stream, MB01 presently appears to support a cold-water fishery. Fish species present in order of abundance included brook trout (*Salvelinus fontinalis*), darter (*Etheostoma olmstedi*), redfin pickerel (*Esox americanus*), chain pickerel (*Esox niger*), and largemouth bass (*Micropterus salmoides*) (Table A7). Total number of individuals was relatively low (n=45), however, most of the available habitat was being utilized. The presence of a large number of native brook trout is indicative of excellent water quality, further corroborating that habitat constraints are most limiting to the aquatic community at MB01. It is appears that these fish were one-year (1+) olds and it is unclear why no young of the year were observed or collected. The presence of darter and redfin pickerel is encouraging in that both are species which thrive in lotic environments. The chain pickerel and largemouth bass most likely originated from Chickering Lake or the small impoundment located just upstream from the sample location.

Spawning habitat for brook trout normally consists of gravelly shallows, especially in areas with upwellings of springwater. As such, sedimentation (resulting from road crossings, construction sites, streambank alteration, etc.) can be extremely detrimental to brook trout spawning habitat and should be minimized. Additional assessment in this stream would help to better document conditions that may threaten the brook trout population present. Efforts to protect flow and habitat quality will be key in maintaining the brook trout, darter, and redfin pickerel assemblage at MB01.

East Branch Neponset River

The East Branch Neponset River is the major tributary to the mainstem Neponset River, and therefore strongly influences downstream water quality conditions. The contributing subwatersheds to the East Branch Neponset River are comprised of tributary systems containing several lakes and impoundments. Discharge from Massapoag, Steep Hill, Beaver Meadow, and Pequit brooks is received by the East Branch before it heads in a westerly direction towards its confluence with the mainstem Neponset River in Canton. Much of the East Branch subwatershed is comprised of various forms of commercial, industrial, and residential development. The urbanized nature of the subwatershed gives way to extensive wetland (Fowl Meadow) near its confluence with the mainstem.

DEP's 1994 resource assessment efforts in the East Branch Neponset River revealed severely degraded conditions. In particular, biological monitoring revealed significant impacts and resulted in an aquatic life use-support determination of "non-support." In addition, the 1994 monitoring survey found water temperature in this tributary to be extremely high (31°C), posing a significant threat to the biota in both the East Branch and in the Neponset River downstream from the confluence.

NE12—East Branch Neponset River, mile point 1.80, downstream from Neponset Street, Canton, MA

Habitat

The NE12 sampling reach began approximately 200 m downstream from Neponset Street in a highly channelized (i.e., banks almost completely "rip-rapped") portion of the stream. The reach was virtually one continuous riffle of varying depths, with large boulders and cobble substrates providing excellent epifaunal habitat for macroinvertebrates. Deep water and large substrates offered good cover for fish, although other forms of stable habitat (e.g., snags, submerged logs, instream vegetation) were absent. Minimally-buffered parking lots adjacent to the sample area and the upstream road crossing offered potential NPS inputs in the form of runoff; however, sediment inputs were not evident during the time of sampling. Bank stability was good along the left (south) bank due to the presence of "rip-rap"; however, vegetative removal and collapsing "rip-rap" along the right (north) bank resulted in considerable erosion and bank instability. Riparian vegetation was extremely reduced along both banks, consisting of a thin layer of red maple (*Acer rubrum*) and ash (*Fraxinus americana*) and a limited herbaceous layer of jewelweed (*Impatiens capensis*), poison ivy (*Rhus radicans*), and rose (*Rosa* sp.). Instream vegetation and algae appeared absent, although turbidity made it difficult to see growth on bottom substrates. NE12 received a total habitat assessment score of 152/200 (Table A6).

Benthos

The NE12 benthos assemblage received a total metric score of only 18, representing 53% comparability to the warm-water reference station (Table A2). The "slightly/moderately impacted" assessment for biological status (relative to warm-water reference conditions) here was the poorest received by a Neponset River sub-basin biomonitoring station during the 1999 watershed survey. Metric values for EPT index (4) and percent dominant taxon (38%) performed particularly poorly relative to the other biomonitoring stations (Table A2), and indicate an unbalanced assemblage dominated by more tolerant filter-feeding taxa. As with the benthos sample collected here during the 1994 DEP biosurvey, hydropsychid caddisflies dominated the assemblage (though not at the extremely hyperdominant levels documented in 1994), indicating high concentrations of FPOM in the water column. It is possible that water quality conditions at NE12 have improved slightly since the 1994 biosurvey, based on increases in taxa richness and better representation by additional trophic groups. Nevertheless, highly productive upstream impoundments—particularly Bolivar and Forge ponds, which were found to be eutrophic during DEP's 1994 lakes survey—no doubt continue to be contributing sources of the FPOM food resource delivered to the NE12 aquatic community. In addition, historically high levels of turbidity in these ponds may contribute to the turbid conditions observed at NE12 during the 1999 biosurvey.

Fish

Fish sampling efficiency rated poor due to fast, deep, and turbid water. Fish species present in order of abundance included fallfish (*Semotilus corporalis*), redbreasted sunfish (*Lepomis auritus*), American eel (*Anguilla rostrata*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), yellow bullhead (*Ameiurus natalis*), largemouth bass (*Micropterus salmoides*), and spottail shiner (*Notropis hudsonius*) (Table A7). As with the 1994 DEP fish survey here, overall numbers of fish were very low (n=36); however, conditions were not conducive to electroshocking and many fish were missed. The fish assemblage is dominated by pond species that are most likely emigrating from the many impoundments located upstream. The presence of impoundments both upstream and downstream of the sampling reach, and the rather limited total length of lotic habitat, in general, makes restoration of a stream fish assemblage problematic.

Pequit Brook

The Pequit Brook subwatershed in Canton, which includes Reservoir Pond, discharges into Forge Pond. From its headwaters in the northeastern corner of Canton, Pequit Brook drains an extensive wetland area before reaching an area of much residential and commercial development in the vicinity of Route 138 and the Reservoir Pond inlet. Downgradient from the pond, the stream meanders through mostly undeveloped forest before entering Forge Pond near the center of Canton.

PB01—Pequit Brook, mile point 0.60, upstream from Sherman Street, Canton, MA

Habitat

The PB01 sampling reach was approximately 0.50 miles upstream from Sherman Street, in a densely forested portion of the subwatershed. Considerable gradient and a variety of large substrates created riffle areas that offered excellent epifaunal habitat to benthic macroinvertebrates. In addition, numerous snags and submerged logs, pools, and large rubble provided excellent fish cover. Bank and riparian habitat parameters were excellent—banks were well-vegetated and stabilized with boulders and root masses. Riparian vegetation was well developed and undisturbed, consisting of a deciduous forest of maple (*Acer* spp.), grey birch (*Betula* sp.), white ash (*Fraxinus americana*), and red oak (*Quercus rubra*). Herbaceous growth—most notably skunk cabbage (*Symplocarpus foetidus*), jewelweed (*Impatiens* *capensis*), and ferns (*Onoclea sensibilis*; *Osmunda regalis*)–was present in the understory and along both stream banks. Moss was the only instream vegetation observed, covering about half of the reach and providing additional microhabitat for benthic organisms. There were no signs of NPS pollution in the sampling reach. PB01 received a total habitat assessment score of 181/200—one of the highest habitat evaluations received by a biomonitoring station during the Boston Harbor watershed survey (Table A6).

Benthos

Despite the presence of a large impoundment upstream, the PB01 benthic community was not hyperdominated by filter-feeders. Rather, the assemblage displayed optimum community structure and balanced trophic structure—a variety of pollution-sensitive taxa were present representing numerous feeding guilds. In fact, total taxa richness (27) was higher than both reference stations and was higher than all but one community sampled during the 1999 biosurveys; EPT richness (7) was actually higher than the cold-water reference station (Table A2 and A3).

PB01 received a total metric score of 30, representing 88% comparability to the warm-water reference station at Hawes Brook (Table A2). In fact, with the exception of the EPT/Chironomidae metric, most metrics performed better than those of NE09. The PB01 macroinvertebrate community was considered "non-impacted" relative to warm-water reference conditions.

The PB01 benthos assemblage received a total metric score of 26, representing 81% comparability to the cold-water reference community (Table A3). An abundance of the midge *Parametriocnemus* sp. at PB01 contributed most to the low scoring EPT/Chironomidae metric and dissimilar community structure relative to reference conditions at 5B01 (Table A3). The high relative abundance of this taxon at PB01 may be significant, as it is known to survive dry conditions or periods of reduced baseflow (Bode, NY DEC, personal communication). The PB01 macroinvertebrate community was found to be "non/slightly impacted" when compared to cold-water conditions; however, the discrepancy in water temperature between PB01 and 5B01—as noted by NepRWA (1999)—suggests that the warm-water conditions at NE09 might be more appropriate for biological comparisons with PB01.

Fish

Fish sampling efficiency was excellent. Fish species present in order of abundance included largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), redfin pickerel (*Esox americanus*), white sucker (*Catostomus commersoni*), and American eel (*Anguilla rostrata*)—the latter four species being represented by a total of eight fish (Table A7). Overall numbers of fish were very low (n=36) with the majority of the fish (n=30) being young-of-the-year of pond species. The apparent inability of Pequit Brook to support a cold-water fishery corroborates the use of the NE09 reference station as the primary reference condition for comparisons to the PB01 benthic community.

The location of Reservoir Pond just upstream, and Forge Pond just downstream is clearly having an impact on the fish assemblage at this station. The majority of the pond fishes present appeared to be young-of-the-year that most likely emigrated from Reservoir Pond during high flows. The physical habitat within the reach does not support stable populations of pond fishes (i.e., reproducing populations represented by multiple age classes). The absence of "stream" species may be due to direct competition with fish originating from the pond and/or periodic low-flow events and inability for re-population to occur from downstream areas. The restoration and maintenance of a more typical stream fish assemblage in this reach may be problematic due to the presence of the pond and the potential for periodic flow interruption. Efforts to restore a stream fish assemblage by maintaining minimum flows may also be ineffective due to competition from pond species emigrating from Reservoir Pond.

Unnamed tributary to Steep Hill Brook

This small subwatershed is the source of the municipal water supply for the town of Stoughton. In 1994, the Stoughton Water Department withdrew an average of 1.17 MGD from wells in the vicinity of

Pinewood, Muddy and Town ponds (MA DEP 1995). From its relatively undeveloped source in Dry Pond, this unnamed tributary to Steep Hill Brook flows in a northerly direction through Muddy and Town ponds. After draining an urbanized portion of the subwatershed in the northwestern corner of Stoughton—including Pinewood Pond—the stream enters Bolivar Pond in Canton.

SB01— Unnamed tributary to Steep Hill Brook, mile point 1.0, downstream from Central Street, Stoughton, MA

Habitat

The SB01 sampling reach began approximately 500 m downstream from Central Street in Stoughton, a short distance downstream from two municipal groundwater supplies for the Town of Stoughton. The reach consisted of a series of well-developed riffle areas interspersed with deep pools that meandered through a forested area and terminated at the downstream extent of a defunct mill. An abundance of cobble and gravel/pebble substrates offered excellent epifaunal habitat for macroinvertebrates, while numerous snags, submerged logs, and overhanging vegetation provided excellent fish cover. Both stream banks were well-vegetated with herbaceous and shrubby growth, especially rose (*Rosa multiflora*), riverbank grape (*Vitis riparia*), poison ivy (*Rhus radicans*), and bittersweet (*Celastrus* sp.). Bank stability was good along the right (east) bank, while the extremely steep nature of the left (west) bank resulted in small areas of erosion along the upper portion of the reach. The effects from dumping (i.e., trash deposits) were observed along much of the left bank, apparently originating from an adjacent shopping center/parking lot and exacerbated by the steepness of the bank and the narrow riparian buffer on this side of the channel. The riparian zone along the right bank was extensive and undisturbed, consisting mainly of red maple (*Acer rubrum*), elm (*Ulmus rubra*), and an uncultivated field. The SB01 biomonitoring station received a total habitat assessment score of 169/200 (Table A6).

Benthos

Temperature data collected by NepRWA (1999) indicate that this stream is incapable of supporting a cold-water fishery. As a result, the warm-water reference station of NE09 was used as the primary reference condition for biological comparisons to the SB01 macroinvertebrate community. SB01 received a total metric score of 20, representing 59% comparability to "least impacted" conditions at NE09 and resulting in a "slightly impacted" bioassessment (Table A2). Comparisons to the cold-water reference yielded similar results (56% comparability; "slightly impacted"). Despite relatively high taxa richness, the SB01 benthos assemblage was characterized by a displacement of pollution-sensitive EPT taxa by moderately tolerant organisms—most notably the filter-feeding hydropsychid caddisflies. Between the hydropsychids and another net-spinning caddisfly, Philopotamidae, filter-feeding caddisflies comprised almost 60% of the benthos sample, indicating a preponderance of suspended FPOM in this portion of this stream. Numerous upstream impoundments—including the highly productive Town Pond, documented as eutrophic due to nuisance and non-native vegetation (MA DEP 1995)—probably deliver an abundance of organic particulates to the SB01 community.

It appears, then, that water quality rather than habitat quality is most limiting to biological potential in this portion of this unnamed Steep Hill Brook tributary. Furthermore, water quality degradation at SB01 and its effects on biological integrity may be exacerbated by occasional periods of reduced baseflow.

Fish

Fish species present in order of abundance included pumpkinseed (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides*), white sucker (*Catostomus commersoni*), chain pickerel (*Esox niger*), and American eel (*Anguilla rostrata*) (Table A7). Overall numbers were very low (n=36) with the majority of the fish (n=29) being young-of-the-year.

The presence of a number of ponds located both upstream and downstream from the sampling reach appears to be dictating community structure in the SB01 fish assemblage. It is unclear whether low-flow events may be affecting habitat in this reach; however, the presence of a number of deep pools should provide refugia during low-flow episodes.

Mystic River Sub-basin

The Mystic River sub-basin has an approximate drainage area of 69 square miles with a population of over 500,000 people. It lies to the immediate north of Boston and its boundaries are entirely within the Commonwealth of Massachusetts. A sizeable portion of the basin, over 23 square miles, forms the Aberjona River which has its origins in Reading. The Aberjona River is the main tributary of the Upper Mystic Lake. The overflow from the Upper Mystic Lake forms the Lower Mystic Lake. Mill Brook is a tributary to the Lower Lake entering at its southerly end. The Mystic River begins at the outlet of the Lower Lake. It flows in a southeasterly direction for a distance of 7.4 river miles through or bordering the towns of Arlington, Medford, Somerville, Everett, Charlestown, and Chelsea before finally discharging into inner Boston Harbor. The Mystic River's main tributaries are Alewife Brook which enters at the Arlington-Somerville line and the Malden River forming the border between the towns of Medford and Everett.

Aberjona River

The Aberjona River flows in a southerly direction for a distance of 8.7 river miles through highly urbanized portions of Wilmington, Woburn, and Winchester before discharging into the Upper Mystic Lake. There are three main tributaries to the Aberjona which are listed in downstream order: Hall's Brook in Woburn, Sweetwater Brook in Woburn, and Horn Pond Brook in Winchester. Sources of pollution in the Aberjona River and its tributaries are in the form of nonpoint source runoff and industrial discharges.

AR01—Aberjona River, mile point 9.70, at USGS gaging station, Winchester, MA

Habitat

The AR01 sampling reach began approximately 100 m downstream from the USGS gaging station in Winchester, terminating at a small dam immediately adjacent to the gage. Much of the reach consisted of deep run/pool areas, with well-developed riffle (shallow and deep) areas present near the top and bottom of the reach. While gravel and sand were the most abundant substrate types in the sampling reach, cobble and larger substrates were common in the riffle areas and provided excellent overall epifaunal habitat for macroinvertebrates. Fish habitat was less than optimal here, with rubble/boulder and a few snags providing the majority of the cover. Instream sediment deposition was observed throughout the reach, with sand and gravel bars present in the lower portion of the reach and moderate deposition evident in the slower pool areas midreach. The numerous stormdrain outfalls, as well as upstream road crossings and adjacent roadways (Mystic Valley Parkway, Washington Street among others) along much of the Aberjona River, probably account for most of the sediment inputs to this portion of the river. The effects of urban runoff in this segment are probably exacerbated by the narrow riparian buffer along both sides of the river. Like much of the Aberjona River, riparian vegetation in the AR01 sampling reach consists of a thin layer of trees (red oak, *Quercus rubra*; elm, *Ulmus rubra*; birch, *Betula* sp.; and silver maple, *Acer saccharinum*) and mowed grassy areas used for recreation. The displacement of trees, shrubs, and herbaceous vegetation by manicured lawn may account for the frequent areas of erosion and instability along both banks in the sampling reach. Filamentous forms of green algae covered approximately 10% of the reach and were restricted to the rocky substrates in the riffle areas. Moderate levels of instream turbidity were observed, suggesting possible water quality degradation. The AR01 biomonitoring station received a total habitat assessment score of 132/200 (Table A6).

Benthos

The AR01 benthos assemblage received a total metric score of 16 when compared to the Hawes Brook reference station. This was the lowest score received by a biomonitoring station in the Boston Harbor watershed survey, representing only 47% comparability to reference conditions and resulting in a biological assessment of "moderately impacted" (Table A4). Reductions in total taxa richness as well as EPT index were indicative of an impaired macroinvertebrate community and poor water quality conditions. Those EPT taxa present—filter-feeding Hydropsychidae—were hyperdominant, comprising over 60% of the sample. The abundance of filter-feeding organisms, along with gathering collectors such as the oligochaete worms and gammarid amphipods, implies that suspended and deposited forms of organic matter are the primary food resources in this portion of the river. In addition, the biotic index for the AR01 benthos assemblage was the second highest of all the Boston Harbor watershed biomonitoring stations, corroborating the effects of organic enrichment and possibly low levels of dissolved oxygen. The absence of a periphyton-based trophic guild (i.e., algal grazers) is evidenced by the conspicuous lack of scrapers among the AR01 macroinvertebrate assemblage.

Past studies conducted by MA DEP (1982; 1989) in the Mystic River sub-basin conclude that the river is affected by typical urban nonpoint sources such as stormwater, in-place sediment, and accelerated eutrophication from excessive nutrient input. Low dissolved oxygen, elevated fecal coliform bacteria, and high ammonia-nitrogen levels all have historically contributed to water quality degradation throughout the sub-basin. Findings of the 1999 biomonitoring survey suggest that water quality impairment remains a problem in the Aberjona River portion of the sub-basin, as indicated by an aquatic community structured in response to organic enrichment and nutrient loadings.

Mill River

Mill Brook is a tributary to Lower Mystic Lake entering at its southerly end. Originating in the eastern portion of Lexington, Mill Brook drains highly urbanized portions of Arlington before entering the Lower Lake near Mt. Pleasant Cemetery. The stream has been culverted underground at several points along its course.

MI01—Mill Brook, mile point 0.30, upstream from Mill Street, Arlington, MA

Habitat

The MI01 sampling reach began approximately 300 m upstream from Mill Street in Arlington, and immediately upstream from a small bridge leading to a restaurant parking lot. Shallow riffle areas comprised of cobble and gravel substrates provided good epifaunal habitat for macroinvertebrates. The shallow nature of the reach, however, along with an obvious lack of stable cover provided fish with very poor habitat. Fish and benthic habitat was compromised by substantial deposits of sand throughout the sampling reach and extremely low baseflow (stream channel <70% full). Flow was further reduced to the point that the channel was completely dry a short distance downstream in Mt. Pleasant Cemetery—the site of the originally proposed sampling reach. The riparian zone in the MI01 sampling reach was typical of a highly urbanized stream—parking lots have resulted in almost complete removal of a vegetative buffer along the right (south) bank while a narrow layer of mowed grass and "false bamboo" (*Polygonum* sp.) comprised the riparian zone along the left bank. Stormdrains, parking lot runoff, and erosion along the right bank all contribute sediment loads to this portion of the stream. MI01 received a total habitat assessment score of 99/200—easily the lowest evaluation of any of the 1999 Boston Harbor watershed biomonitoring stations (Table A6).

Benthos

The MI01 benthos received a total metric score of 20, representing 59% comparability to the NE09 reference station (Table A4). While the resulting bioassessment for MI01 was "slightly impacted," it is possible that biological integrity at this station is more degraded than is indicated from the RBP analysis. The absence of EPT taxa, coupled with the highest biotic index (7.50) of any of the 1999 biomonitoring stations, indicate water quality degradation relating to organic enrichment and possibly low levels of dissolved oxygen at MI01. The relatively high taxa richness for the MI01 assemblage is misleading, as virtually all taxa present are either chironomids or oligochaete worms that display high tolerance of organic pollution, no doubt contributing to the high biotic index at this station. In addition, the dominance of the MI01 benthic community by the chironomid *Micropsectra* sp. may reflect the low-flow conditions evident here during the 1999 biosurvey, as this taxon has been known to predominate in streams subjected to periods of reduced flow (Fiorentino 2000; Fiorentino 1999; Bode, NY DEC, personal communication). Decreasing discharge and the subsequent elimination of epifaunal habitat at MI01 may also contribute to the conspicuous absence of EPT taxa, as many of these organisms are particularly susceptible to substrate exposure and stranding.

It appears, then, that habitat degradation in the form of sediment deposition, riparian vegetation removal, and substrate exposure due to low baseflow—coupled with water quality degradation from organic loadings—compromise biological integrity in this portion of Mill Brook.

Weymouth/Weir River Sub-basin

The Weymouth/Weir River sub-basin is located in southeastern Massachusetts, and drains into Hingham Bay. The following municipalities are located in the sub-basin: the City of Quincy, the towns of Randolph, Braintree, Hingham, Holbrook, Weymouth, and portions of Avon and Rockland. The Weymouth/Weir sub-basin is comprised of five subwatersheds—Furnace Brook, Town River, Weymouth Fore River, Weymouth Back River, and Weir River. Furnace Brook, a 2.7 mile stream located in Quincy, flows northeast to Blacks Creek which drains to Quincy Bay, and the remaining four rivers flow generally northeast to Hingham Bay. The Weymouth Fore and Weymouth Back Rivers are both tidally influenced.

The Town River system originates as Town Brook in the Blue Hills. The stream flows 3.2 miles from the Old Quincy Reservoir through downtown Quincy to the Town River. The Town River then flows into Town River Bay, which joins with the Weymouth Fore River at Germantown Point before flowing into Hingham Bay.

The Weymouth Fore River system originates at Lake Holbrook in Holbrook, and flows northerly as the Cochato River for 4.0 miles. The Farm River, a 2.7 mile river beginning in Milton, joins the Cochato River in Braintree to form the Monatiquot River. The Monatiquot River, considered the mainstem, flows north then east for a total of 4.3 miles to the Weymouth town line where the river becomes a tidal estuary and is called the Weymouth Fore River. Several of the tributaries that contribute to the river's flow are: Lee Brook, Glovers Brook, Tumbling Brook, and Cranberry Brook.

The Weymouth Back River system is to the east of the Weymouth Fore River, and the hydrology parallels that of the Weymouth Fore River. The Old Swamp River originates in Rockland and flows northerly for 4.4 miles to the south of Whitmans Pond. The Mill River originates at the outlet of Weymouth Great Pond and flows 3.5 miles to the western shores of Whitman Pond. The Weymouth Back River originates at the outlet of Whitmans Pond in Weymouth. It flows northerly under a network of streets and intersections for 0.8 miles to the Weymouth Back River estuary, forming the town line between Weymouth and Hingham.

The final subwatershed is the Weir River, the easternmost of the five rivers. The Weir River is formed at the confluence of Crooked Meadow River and Fulling Mill Brook, and flows 2.8 miles to its tidal portion in Hingham. This system is comprised of the Plymouth, Crooked Meadow, and Weir rivers. Tributaries to these rivers include Accord Brook, Norroway Brook, Tumbling Brook, and the Eel River.

Monatiquot River

The Monatiquot River drains extremely urbanized portions of Braintree and Quincy as it makes its way eastward towards its tidally influenced mouth—an important smelt spawning area—at the Weymouth Fore River. Heavy industrial, commercial, and residential development threaten habitat and biological integrity throughout the entire subwatershed.

MR01—Monatiquot River, mile point 5.80, downstream from Middle Street, Braintree, MA

Habitat

Although the EOEA Boston Harbor Watershed team requested that macroinvertebrate sampling be conducted near the mouth of the Monatiquot River near McCusker Drive, the extremely limited epifaunal habitat made application of DWM macroinvertebrate sampling protocols problematic. As a result, sampling was conducted a short distance upstream in a reach between Middle Street and Adams Street in East

Braintree. A considerably more productive reach in terms of instream habitat availability, sampling at MR01 allowed for a more useful interpretation of the benthos data, particularly as it relates to overall water quality in this portion of the river. The MR01 biomonitoring station began approximately 100 m downstream from Middle Street, in a shallow stretch of water dominated by rocky substrates and good current velocity. The abundance of boulders and cobble subjected to well-developed riffles provided excellent epifaunal habitat for macroinvertebrates. Fish cover was only marginal due to the lack of stable habitat and shallow nature of the reach. The reach was almost completely channelized, with “rip-rap” placed along both banks. Despite the reinforcement of both banks with these large boulders, occasional areas of erosion and sloughing were observed, possibly due to vegetative removal along the banks and disruption of the riparian zone. Only a few red maples (*Acer rubrum*) separated the left (west) bank from the expansive parking lot of a construction equipment and materials business—piles of excavated materials were deposited at numerous points along the bank. Red maple and “false bamboo” (*Polygonum cuspidatum*) comprised the reduced riparian zone along the right (east) bank. With the exception of occasional patches of filamentous green algae and mosses, instream aquatic vegetation was absent. In addition to probable NPS inputs from the adjacent construction company, nonpoint source pollution observed in the sampling reach existed mainly as trash and sediment deposits. Silty deposits on the instream substrates and in pools probably originate from the numerous upstream road crossings and adjacent roadways. Runoff potential in this portion of the Monatiquot River is probably increased by the largely impervious nature of the surrounding landscape in this subwatershed. MR01 received a total habitat assessment score of 128/200—the second lowest habitat score received by a Boston Harbor watershed station during the 1999 survey (Table A6).

Benthos

Metric scores calculated for the MR01 benthos assemblage totaled 16, representing 47% comparability to the reference station at Hawes Brook (Table A5). Loss of EPT taxa and scrapers, as well as hyperdominance of one taxon, contribute to the “moderately impacted” conditions at MR01 (Table A5). Filter-feeding hydropsychid (*Cheumatopsyche* sp.; *Hydropsyche betteni* gr.) and philopotamid (*Chimarra* sp.) caddisflies have displaced virtually all other taxa and trophic guilds at this station, indicating a highly unbalanced community responding to an overabundance of FPOM in the water column (Table A1). Heavy deposits of fine organic material, comprising 95% of the organic substrate components at MR01, were observed throughout the sampling reach and corroborate that fine organics are the dominant food resource in this portion of the river. Moderate levels of turbidity, probably caused by the heavy loads of sediment or suspended material often associated with eutrophic conditions, were observed at the MR01 station as well. These fine materials can be deleterious because they can reduce light penetration and consequently plant growth (instream aquatic vegetation was minimal at MR01), smother hard surfaces, and fill interstices within the substrate (Wiederholm 1984). Resident biota at MR01, then, may be subsequently affected by obstructions in food collection or respiration caused by fine deposits of organic material. Eutrophication of upstream impoundments, as well as direct nutrient/organic loadings to the Monatiquot River itself probably account for the organically enriched conditions reflected in the aquatic community at MR01. In addition to water quality constraints, habitat degradation (especially riparian) probably compromises biological integrity at MR01 as well—though to a lesser degree.

Old Swamp River

A much less developed subwatershed than the Monatiquot River, the Old Swamp River drains residential portions of Rockland and Weymouth as it makes its way northward to Whitmans Pond. A good deal of this subwatershed remains open space, often in the form of vast wetland areas. Adjacent sewage overflows and septic systems threaten water quality in the Old Swamp River, while heavy water withdrawals may impact instream/riparian habitat and resident instream biota.

SR01—Old Swamp River, mile point 0.40, upstream from USGS gage, Weymouth, MA

Habitat

Nestled in the narrow wooded strip between the north and southbound lanes of Route 3 in Weymouth, the SR01 sampling reach began at the USGS gage and extended upstream under a closed canopy for approximately 100 m. Riffle areas were common—albeit shallow—and comprised of abundant rocky substrates that afforded excellent epifaunal habitat to macroinvertebrates. In addition, an abundance of instream mosses and large root masses provided benthic microhabitat as well. Fish habitat, however, suffered from a lack of stable cover and slight sand deposition in pools. Sand inputs may be the result of runoff from Route 3 or sources further upstream. Reconnaissance activities conducted upstream revealed areas of massive riparian zone removal and erosion in the vicinity of a housing development located between Pleasant Street and Oak Street in Weymouth. Both stream banks were well-vegetated and moderately stable, and despite the proximity of the adjacent highway, a hardwood forest dominated by red maple (*Acer rubrum*) and birch (*Betula* sp.) provided an adequate riparian buffer. The SR01 sampling reach received a total habitat assessment score of 147/200 (Table A6).

Benthos

The SR01 benthos received a total metric score of 22, representing 65% comparability to the reference station NE09 (Table A5). Community composition—especially richness of sensitive taxa—was slightly less here than expected given the optimal epifaunal habitat available. A reduction in EPT taxa, and the displacement of these intolerant forms by the Chironomidae, led to metric score reductions that resulted in a "slightly impacted" bioassessment. It is unclear whether the reduced EPT index is the result of low dissolved oxygen levels—historically in violation of water quality standards in this portion of the river (MA DEP 1991)—or other forms of environmental stress. High scores (6) for taxa richness, biotic index, and scraper/filterer metrics suggest the SR01 community remains fairly balanced (i.e., not skewed toward a particular trophic group), and is not structured in response to serious organic enrichment.

Weir River

The extensive drainage area of this subwatershed encompasses much of Hingham, as well as parts of Weymouth, Hull, and Cohasset. The Weir River flows through an area of multiple land uses—residential, commercial, recreational—as it heads northward towards its tidally influenced mouth and Hingham Bay. Urban NPS inputs originating in Hingham Center, as well as heavy water withdrawals throughout the subwatershed, pose the greatest threat to water quality and biological integrity in the Weir River.

WR01—Weir River, mile point 4.0, upstream from Route 228, Hingham, MA

Habitat

The WR01 sampling reach began immediately upstream from Route 228 in a fairly rural portion of Hingham and extended upstream for 100 m. Riffle areas were somewhat limited, restricted to the top and bottom portions of the reach. Rocky substrates were abundant yet small, consisting mostly of small-sized cobble and pebble. Sand and gravel comprised about half of the reach. Dense beds of aquatic vegetation—most notably pondweed (*Potamogeton* sp.), smart weed (*Polygonum* sp.), and mosses provided additional microhabitat for macroinvertebrates; however, epifaunal habitat was considered less than optimal. Fish habitat was worse, with instream vegetation and overhanging shrubs providing the only cover. Considerable instream sediment deposition further compromised fish and macroinvertebrate habitat. Instream algal cover was minimal, consisting of a thin green film on rocky substrates and submerged logs; however, an abundance of filamentous green algae had been observed during reconnaissance activities here during the spring. Both banks were well-vegetated with wetland vegetation and shrubs, and only infrequent small areas of erosion were observed. Riparian vegetation was diverse and undisturbed, with a wooded area comprised of red maple (*Acer rubrum*), elm (*Ulmus rubra*), white ash (*Fraxinus americana*), and willow (*Salix* sp.) near the lower half of the right (east) bank giving way to shrubby layers of riverbank grape *(Vitis riparia*) and pasture. An unmowed field of purple loosestrife (*Lythrum salicaria*), rose (*Rosa* sp.), and grasses along the left (west) bank provided a good vegetative buffer from the adjacent road (Route 228). WR01 received a total habitat assessment score of 143/200 (Table A6).

Benthos

The WR01 benthos assemblage received a total metric score of 28, representing 82% comparability to reference conditions at NE09 and placing it just outside the "non-impacted" category for biological condition (Table A5). Taxa richness (24) and biotic index (5.14) were comparable to the reference community, while an EPT index of 6 was only slightly less (Table A5). Unlike most biomonitoring stations in the Boston Harbor watershed, the Weir River community was not dominated by the filter-feeding organisms often reflective of enriched conditions, as indicated by the high value for the scraper/filterer metric (Table A5). Rather, the presence of numerous feeding groups indicates balanced trophic structure and multiple food resources in this portion of the river. An abundance of fairly intolerant heptageniid mayflies and elmid beetles (e.g., *Stenelmis* sp.), both of which require well-oxygenated instream conditions, corroborates the importance of periphyton as a food resource at WR01.

The greatest threat to the resident benthic community at WR01 may be instream sedimentation. Sand and other fine sediments drastically reduce macroinvertebrate microhabitat by filling the interstitial spaces of epifaunal substrates. In addition, the filling of pools with sediment reduces fish cover and may be detrimental to fish egg incubation.

SUMMARY/RECOMMENDATIONS

Hawes Brook (NE09)—Upstream impoundments clearly influence trophic structure of the NE09 benthos assemblage, as well as community composition of the resident fish community. And while the benthic community at this reference station appeared relatively healthy, habitat degradation poses a serious threat to biological integrity in this portion of Hawes Brook. In particular, removal and/or disturbance of riparian vegetation may exacerbate the effects of NPS pollution related to yard waste originating from adjacent residences. Outreach efforts are recommended to educate residents on how improper yard waste disposal impacts aquatic life "in their own back yard," as well as the importance of maintaining a riparian buffer zone. In addition, local clean-up efforts to remove instream trash and debris should be encouraged. Biomonitoring should be conducted here again during the 2004 DEP watershed survey in this basin.

Traphole Brook (5B01)—Both the macroinvertebrate and fish communities were dominated by highly sensitive taxa, reflecting overall excellent biological integrity and good water quality in this portion of Traphole Brook. Every effort should be made to maintain the diverse benthic community and cold-water fishery found here. Maintaining current baseflow as well as instream and riparian habitat is essential, and biomonitoring (macroinvertebrates and fish) is strongly recommended during the next "year 2 activities" for this basin.

Massapoag Brook (9BOB)—Despite the excellent instream and riparian habitat available here, the macroinvertebrate community was moderately impacted and indicative of enriched conditions. Nutrient/organic loadings originating from inadequate septic systems, or miscellaneous forms of urban runoff, probably contribute to the productive conditions of upstream impoundments that supply an abundant FPOM food resource to the 9BOB aquatic community. Outreach on septic system maintenance in concert with investigation of septic systems in this subwatershed should be conducted. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

Beaver Brook (BB01)—Though the BB01 macroinvertebrate community was only minimally impaired, the presence of potential "low-flow" indicator species, as well as a suppressed fish population despite the excellent fish habitat, suggest that occasional periods of reduced baseflow may compromise biological potential in this stream. The presence of highly intolerant forms of fish and invertebrates suggests that factors (e.g., water quantity) other than water quality may most influence biological integrity here. Additional fish community and macroinvertebrate sampling should be conducted here during the next "year 2" phase of the "basin cycle" for this subwatershed. Monitoring physico-chemical parameters such as dissolved oxygen and pH may aid in the interpretation of future biomonitoring data collected here.

Beaver Meadow Brook (BM01)—Upstream impoundments no doubt are a contributing source of FPOM to the BM01 macroinvertebrate community, and probably have a more significant influence on fish and benthic community structure than do fluctuating baseflow levels in this portion of Beaver Meadow Brook.

It is unclear the extent that current water quality conditions in the upstream impoundments may affect instream turbidity at BM01; however, other potential sources (e.g., runoff from nearby roads, parking lots, and numerous gravel pits) no doubt exist in this subwatershed and should be investigated. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

Mill Brook (MB01)—It appears that habitat is almost certainly limiting biological potential at MB01. Instream habitat constraints related to reduced baseflow (e.g., exposed/unavailable substrates and fish cover, lack of pools, shallow riffles), in particular, appear to compromise biological integrity in this portion of Mill Brook. Numerous macroinvertebrate taxa thought to display adaptations to reduced flow were observed at MB01. The presence of a cold-water salmonid fishery, as well as other sensitive fish species suggest that water quality here is generally good. Environmental impacts due to reduced flow, and changes in water quality (elevated temperatures) from water supply well withdrawals in a small subwatershed such as Mine/Mill Brook, combined with increases in residential developments, and an out-of-basin transfer of the wastewater via the sewer system, may very well be manifested by changes in the aquatic environment. It is strongly recommended that strict water conservation measures be employed by the communities in the Mine/Mill Brook system. In addition, outreach efforts should be aimed at consumers to make them aware of the environmental consequences of ever-increasing demands for water, and of measures that can be taken to alleviate existing adverse effects on limited water supplies.

In addition, instream deposition threatens biological integrity at MB01 as well. Sediment inputs—which can be detrimental to trout spawning habitat and epifaunal benthos habitat, and that most likely originate from the Millbrook Road crossing—should be minimized here. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

East Branch Neponset River (NE12)—Highly productive upstream impoundments, which deliver warm FPOM-rich water to the aquatic community at NE12, strongly influence fish and macroinvertebrate community structure and function here. Despite the reduced riparian buffer on either side of the river, water quality rather than habitat quality is probably most limiting to biological integrity in this portion of the Neponset River. Water quality impairment in upstream impoundments, particularly Bolivar and Forge ponds, will need to be addressed before improvements in biological conditions of downstream lotic communities are to be realized. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

Pequit Brook (PB01)—The large reservoir upstream appears to influence community structure of the PB01 fish population more than the resident benthos. The benthic community here was “non-impacted,” although the dominance of *Micropsectra* sp. may indicate occasional baseflow reductions. Likewise, a fairly suppressed fish community and lack of reproducing pond species—despite the excellent habitat available during the sampling period—suggest periodic flow interruption. While occasional low baseflow in this stream may be naturally-occurring (i.e., there are no known water withdrawals in this subwatershed), an investigation of water release practices in Reservoir Pond may be warranted. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004.

Unnamed tributary to Steep Hill Brook (SB01)—Numerous upstream impoundments—including the highly productive Town Pond, documented as eutrophic due to nuisance and non-native vegetation (MA DEP 1995)—probably deliver the high densities of organic particulates that shape community structure and function at SB01. While water quality rather than habitat quality appears most limiting to biological potential in this portion of the stream, the extent that water quality degradation at SB01 and its effects on biological integrity may be exacerbated by occasional periods of reduced baseflow is unknown. The dumping of trash along the left (west) bank should be discouraged. Biomonitoring (macroinvertebrates and fish) is recommended here during the next DEP watershed survey in 2004..

Aberjona River (AR01)—As this is a highly urbanized subwatershed, it is not surprising that the AR01 benthic community is structured in response to organic enrichment and nutrient loadings. While it will be difficult to eliminate or isolate sources of urban runoff (stormwater, road runoff, illicit sewer connections) that most impact biological integrity in the Aberjona River, streambank stabilization and restoration of an adequate riparian buffer may help to alleviate the effects of some NPS inputs to this portion of the river.

Mill Brook (MI01)—Habitat degradation in the form of sediment deposition, riparian vegetation removal, and substrate exposure due to low baseflow—coupled with water quality degradation from organic loadings—compromise biological integrity at MI01. The culverting of segments of this stream, and the highly urbanized nature of this subwatershed, make elimination and/or isolation of urban inputs problematic. However, streambank stabilization and restoration of a riparian buffer would help to reduce the effects of road and parking lot runoff in this portion of Mill Brook.

Monatiquot River (MR01)—Eutrophication of upstream impoundments, as well as direct nutrient/organic loadings to the Monatiquot River itself probably account for the organically enriched conditions reflected in the aquatic community at MR01. In addition to water quality constraints, habitat degradation (especially riparian) probably compromises biological integrity at MR01 as well—though to a lesser degree. A site visit to the construction/excavating company adjacent to the MR01 reach is recommended to determine the extent that the property is a source (though other upstream sources no doubt exist) of sediment inputs to this portion of the river. Improvements to the riparian zone along the left bank of the reach would be beneficial as well. A stream clean-up effort would address the trash that apparently enters the river from the Middle Street crossing.

Old Swamp River (SR01)—Impairment to the SR01 benthic community appears to be the result of water quality degradation rather than habitat limitations. In addition, water quality effects may be exacerbated by periodic water withdrawal-induced flow reductions, although evidence of habitat constraints (e.g., exposed epifaunal substrates) resulting from reduced baseflow was not observed during the time of sampling. Septic system failures and sewer overflows are a perceived threat to water quality, while riparian disturbances and streambank erosion in the vicinity of Pleasant Street may deliver sediment loads to this portion of the river. Biomonitoring is recommended here during the next DEP watershed survey in 2004. Fish population sampling, which has not historically been done by DEP in this subwatershed, should accompany the macroinvertebrate sampling effort.

Weir River (WR01)—Although the resident biota at WR01 appear only minimally impacted at most, instream deposition threatens biological integrity in this portion of the river. Origins of sedimentation are unknown; however, upstream road crossings and other potential sources of sediment inputs should be investigated. BMP implementation or more efficient street sweeping practices in the vicinity of Hingham Center may reduce sediment loads to this portion of the Weir River. Biomonitoring is recommended here during the next DEP watershed survey in 2004. Fish population sampling, which has not historically been performed by DEP in this subwatershed, should accompany the macroinvertebrate sampling effort.

REFERENCES

Barbour, M. T., J. B. Stribling, and J. R. Carr. 1995. The multimetric approach for establishing biocriteria and measuring biological condition. pp. 63-80. *in* W. S. Davis and T. P. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL. 415 p.

Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. Office of Water, US Environmental Protection Agency, Washington, DC. 151 p. + appendices.

Fiorentino, J. F. 2000. Blackstone River Watershed Benthic 1998 Biological Assessment. Technical Memorandum. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester MA. 42 p.

Fiorentino, J. F. 1999. Charles River Watershed 1997/1998 Water Quality Assessment Report: Appendix C—1997 Charles River Watershed Biological Monitoring. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. 64 p.

Hartman, E. M. 1992. 1991 Blackstone River Dry Weather Survey: Ambient Water Quality and Wastewater Discharge Data. Pages 1-1 – 1-110 *in* USEPA, MA DEP, RIDEM, and University of Rhode Island (editors) Blackstone River Initiative Phase 1: Dry Weather Assessment Report of Data 1991. 260 p.

Hughes, R. M. 1989. Ecoregional Biological Criteria. Water Quality Standards for 21st Century. 147-151.

Karr, J. R., K. D. Fausch, P. L. Angermeier, P. R. Yant, and I. J. Schlosser. 1986. Assessing Biological Integrity in Running Waters: A Method and Its Rationale. Special Publication 5. Illinois Natural History Survey. Champaign, IL. 28 p.

MA DEP. 1989. 1986 Mystic River Water Quality Data. Massachusetts Department of Environmental Protection. Division of Water Pollution Control. Technical Services Branch. Westborough, MA. 77 p.

MA DEP. 1991. 1989 Weymouth and Weir River Basins. Water Quality Data, Wastewater Discharge Data, Lake Water Quality Data, Water Quality Analysis. Massachusetts Department of Environmental Protection. Division of Water Pollution Control. Technical Services Branch. Westborough, MA. 49 p.

MA DEP. 1995. The Neponset River Watershed 1994 Resource Assessment Report. Massachusetts Department of Environmental Protection. Office of Watershed Management. Grafton, MA. 104 p. + appendices.

MA DEQE. 1982. The Mystic River Water Quality Data, 1979, 1980 & 1981. Massachusetts Department of Environmental Quality Engineering. Division of Water Pollution Control. Technical Services Branch. Westborough, MA. 64 p.

Merritt, R. W. and K. W. Cummins (eds.). 1996. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Co. Dubuque, IA. 862 p.

Merritt, R. W., K. W. Cummins, and T. M. Burton. 1984. The role of aquatic insects in the processing and cycling of nutrients. pp. 134-163. *in* V. H. Resh and D. M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Publishers, New York, NY. 625 p.

Minshall, G. W. 1984. Aquatic insect-substratum relationships. pp. 358-400. *in* V. H. Resh and D. M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Publishers, New York, NY. 625 p.

NepRWA. 1998. Draft. Budgets: Balancing Uses with Demands and Generating Effective Techniques for Sustainability. Study Design. Neponset River Watershed Association. Canton, MA. 30 p.

NepRWA 1999. Draft. Quality Assurance Project Plan for task 1: The Water Balance. Budgets: Balancing Uses with demands and Generating Effective Techniques for Sustainability. Neponset River Watershed Association. Canton, MA.18 p.

Nuzzo, R. 1999. Standard Operating Procedures (Working Draft): Water Quality Monitoring in Streams Using Aquatic Macroinvertebrates. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. 8 p.

Peckarsky, B. L., P. R. Fraissinet, M. A. Penton, and D. J. Conklin, Jr. 1990. Freshwater macroinvertebrates of northeastern North America. Comstock Publishing Assoc. Ithaca, NY. 442 p.

Resh, V. H. 1988. Variability, accuracy, and taxonomic costs of rapid bioassessment approaches in benthic biomonitoring. Presented at the 36th annual North American Benthological Society meeting at Tuscaloosa, Alabama, 17-20 May 1988.

Simon, T. P. ed. 1999. Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities. CRC Press LLC. 671 p.

Simpson, K. W. and R. W. Bode. 1980. Common larvae of Chironomidae (Diptera) from New York State streams and rivers, with particular reference to the fauna of artificial substrates. Bull. N. Y. S. Museum. 450: 1-133.

Tetra Tech, Inc. 1995. Massachusetts DEP Preliminary Biological Monitoring and Assessment Protocols for Wadeable Rivers and Streams. Method 003: Preliminary biological monitoring and assessment protocols for pulsed DC electrofishing. Prepared for Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. 7 p.

US EPA. 1995. Generic Quality Assurance Project Plan Guidance for Programs Using Community Level Biological Assessment in Wadeable Streams and Rivers. U.S. Environmental Protection Agency, Office of Water. 71 p.

Ward, J. V. 1984. Ecological perspectives in the management of aquatic insect habitat. pp. 558-577. *in* V. H. Resh and D. M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Publishers, New York, NY. 625 p.

Wetzel, R. G. 1975. Limnology. W. B. Saunders Co., Philadelphia, PA. 743 p.

Wiederholm, T. 1984. Responses of aquatic insects to environmental pollution. pp. 508-557. *in*. V. H. Resh and D. M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Publishers, New York, NY. 625 p.

Wiley, M. and S. Kohler. 1984. Behavioral adaptations of aquatic insects. pp. 101-133. *in*. V. H. Resh and D. M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Publishers, New York, NY. 625 p.

APPENDIX

Macroinveretebrate taxa list, RBPIII analyses, and Habitat evaluations

Table A1. Species-level taxa list and counts, functional feeding groups (FFG), and tolerance values (TV) for macroinvertebrates collected from stream sites in the Boston Harbor watershed between 6 and 9 July 1999. Refer to Table 1 for a complete listing and description of sampling stations.

TAXON	FFG	TV	5B01	9BOB	AR01	BB01	BM01	MB01	MI01	MR01	NE09	NE12	PB01	SB01	SR01	WR01
Ferrissia sp.	SC	6				1										
Gyraulus parvus	SC	8										1				
Laevapex fuscus	SC	7														2
Physidae	GC	8			1	1						3		1		
Pisidiidae	FC	6			8	1				1	4	4	2	1		2
Lumbricina	GC	8							1							
Enchytraeidae	GC	10	1						6							
Nais behningi	GC	6	1													
Nais communis	GC	8					2		18				1			
Nais elinguis	GC	10			3				1							
Nais simplex	GC	6							2							
Nais variabilis	GC	10							8							
Pristinella osborni	GC	10							2							
Tubificidae IWB	GC	10			5											
Tubificidae IWH	GC	10							1							
Lumbriculus variegatus	GC	5	7			1	3	1		3	4		10		11	2
Glossiphoniidae	PR	7														1
Caecidotea communis	GC	8					1			1			1		2	2
Crangonyx sp.	GC	6			1											1
Gammarus sp.	GC	6			14	7	4		1	4		2	3	2	22	12
Hydrachnidia	PR	6				1		1			1	3	1		2	1
Baetidae	GC	4												1		
Baetidae (short terminal filament)	GC	6	7													
Baetidae (subequal terminal filament)	GC	6												2		
Heptageniidae	SC	4		4			1	2			3	1	8			12
Leptophlebiidae	GC	2				1										
Stenonema sp.	SC	3						1					3			1
Coenagrionidae	PR	9				1								1		
Isoperla sp.	PR	2	1													
Leuctra sp.	SH	0	38													
Paragnetina sp.	PR	1				7										
Peltoperlidae	SH	0	5													
Perlesta placida	PR	5											2			1
Plecoptera	GC	3		1										2		
Nigronia sp.	PR	0	1	2		2	1	1			2		3	4	1	
Cheumatopsyche sp.	FC	5		14	23	3	16	2		23	24	12	6	25	7	7
Chimarra sp.	FC	4		30		11	27	1		12	15	9	6	13	11	2
Dolophilodes sp.	FC	0	4													
Glossosoma sp.	SC	0				1	1				2				2	
Hydropsyche betteni gr.	FC	6		34	39		11	9		43	15	36	7	10	7	7
Hydropsyche morosa gr.	FC	6	11			5	3				8					
Hydropsyche sp.	FC	4					1									
Hydropsychidae	FC	4				4	5	11					3	10		7
Neophylax sp.	SC	3											1			

Oecetis sp.	PR	5									4					
Phylocentropus sp.	FC	5														1
Pycnopsyche sp.	SH	4											1			
Macronychus glabratus	SH	5											1			
Optioservus sp.	SC	4	6			1									1	1
Oulimnius latiusculus	SC	4	7					6						1	1	
Promoresia sp.	SC	2				11										
Promoresia tardella	SC	2	8			2										
Psephenus herricki	SC	4														5
Stenelmis crenata	SC	5						1								
Stenelmis sp.	SC	5				1	4	1			3		8		1	18
Brillia sp.	SH	5							2							
Chelifera sp.	PR	6	1					2	2				2			
Chironomini	GC	6						1								
Chironomus sp.	GC	10							3							
Cladotanytarsus sp.	FC	5														2
Conchapelopia sp.	PR	6			1		1	4	6	3			1	2	3	3
Corynoneura sp.	GC	4													1	
Cricotopus annulator	SH	7			1				1							
Cricotopus bicinctus	GC	7							1							
Cricotopus intersectus gr.	SH	7							1							
Cricotopus sp.	SH	7											1			
Cricotopus/Orthocladius sp.	GC	7							1							
Cryptochironomus sp.	PR	8												1		
Diamesa sp.	GC	5	1			1	3		3		3	1		1	2	
Diamesinae	GC	2							1							
Dicranota sp.	PR	3	2			2		1								
Eukiefferiella devonica gr.	GC	4						1							1	
Heleniella sp.	GC	5							1							
Hemerodromia sp.	PR	6			1		1		8	4	1		1	1		
Krenopelopia sp.	PR	7				2										
Larsia sp.	PR	7						1								
Meropelopia sp.	PR	6				1										
Micropsectra sp.	GC	7	1					15	21							
Micropsectra/Tanytarsus sp.	FC	7.													1	
Microtendipes pedellus gr.	FC	6				2										4
Microtendipes rydalensis gr.	FC	6				11										
Microtendipes sp.	FC	5												1		
Nanocladius sp.	GC	7										1				
Orthocladiinae	GC	5				1										
Orthocladius sp.	GC	6							2			1				
Paradelphomyia sp.	PR	5						1								
Parametriocnemus sp.	GC	5				5	2	2			2		18	6	5	
Phaenopsectra sp.	SC	7							1							
Polypedilum aviceps	SH	4				6		4								
Polypedilum flavum	SH	6		14			1					2	1	3		
Polypedilum illinoense	SH	6				2			1			2				
Polypedilum laetum	SH	6						3								
Polypedilum scalaenum	SH	6			1											
Potthastia longimana gr.	GC	2												1		
Probezzia sp.	PR	6	1													
Rheopelopia sp.	PR	4				2										
Rheotanytarsus	FC	6	2					10				2	3		2	1

Rheotanytarsus exiguus gr.	FC	6		1			1	9			3	13	5	4	1	
Simulium sp.	FC	5				1	2			2			1	1	1	
Simulium tuberosum complex	FC	4	2								1					
Simulium venustum complex	FC	5														1
Simulium vittatum complex	FC	9							9							
Stempellinella sp.	GC	2						1								
Symposiocladius lignicola	SH	5		1												
Tanytarsus sp.	FC	6				4		1	1	2						1
Thienemannimyia gr.	PR	6						1								
Thienemannimyia sp.	PR	6			2				5						1	
Tipula sp.	SH	6													1	
Tribelos sp.	GC	7			1											
Tvetenia bavarica gr.	GC	5	3			2	7	7			1		1	8	3	
Tvetenia sp.	GC	5														1
Tvetenia vitracies gr.	GC	5								1						10
Xenochironomus sp.	PR	0										1				
Zavrelia sp.	FC	4				2							1			
TOTAL			**110**	**101**	**101**	**106**	**98**	**101**	**110**	**99**	**96**	**94**	**102**	**102**	**90**	**109**

[1] Functional Feeding Group (FFG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.

[2] Tolerance Value (TV) is an assigned value used in the calculation of the biotic index. Tolerance values range from 0 for organisms very intolerant of organic wastes to 10 for organisms which are very tolerant.

Table A2. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Neponset River sub-basin between 6 and 8 July 1999. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (NE09), and the corresponding assessment designation for each biomonitoring station. Refer to Table 1 for a complete listing and description of sampling stations.

STATION #	**NE09**		**9BOB**		**BB01**		**BM01**		**MB01**		**NE12**		**PB01**		**SB01**	
STREAM	Hawes Brook		Massapoag Brook		Beaver Brook		Beaver Meadow Brook		Mill Brook		E. Branch Neponset River		Pequid Brook		Steep Hill Brook tributary	
HABITAT SCORE	131		183		179		176		143		152		181		169	
TAXA RICHNESS	18	*6*	9	*2*	31	*6*	20	*6*	26	*6*	17	*6*	27	*6*	22	*6*
BIOTIC INDEX	4.93	*6*	5.03	*6*	4.35	*6*	4.87	*6*	5.36	*6*	5.68	*6*	4.92	*6*	4.83	*6*
EPT INDEX	7	*6*	5	*2*	6	*4*	6	*4*	5	*2*	4	*0*	7	*6*	5	*2*
EPT/CHIRONOMIDAE	7.89	*6*	5.19	*4*	0.78	*0*	4.33	*4*	0.43	*0*	2.52	*2*	1.19	*0*	2.33	*2*
SCRAPERS/FILTERERS	0.11	*6*	0.05	*4*	0.39	*6*	0.09	*6*	0.26	*6*	0.03	*2*	0.59	*6*	0.02	*0*
% DOMINANT TAXON	25%	*4*	34%	*2*	10%	*6*	28%	*4*	15%	*6*	38%	*2*	18%	*6*	25%	*4*
TOTAL METRIC SCORE		*34*		*20*		*28*		*30*		*26*		*18*		*30*		*20*
% COMPARABILITY TO REFERENCE STATION			59%		82%		88%		76%		53%		88%		59%	
BIOLOGICAL CONDITION -DEGREE IMPAIRMENT	**REFERENCE**		**SLIGHTLY IMPACTED**		**NON/ SLIGHTLY IMPACTED**		**NON-IMPACTED**		**SLIGHTLY IMPACTED**		**SLIGHTLY/ MODERATELY IMPACTED**		**NON-IMPACTED**		**SLIGHTLY IMPACTED**	

Table A3. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Neponset Rive sub-basin between 6 and 8 July 1999. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (5B01), and the corresponding assessment designation for each biomonitoring station. Refer to Table 1 for a complete listing and description of sampling stations.

STATION #	**5B01**		**BB01**		**MB01**		**MB01**		**PB01**		**SB01**	
STREAM	Traphole Brook		Beaver Brook		Beaver Meadow Brook		Mill Brook		Pequid Brook		Steep Hill Brook tributary	
HABITAT SCORE	168		179		176		143		181		168	
TAXA RICHNESS	21	*6*	31	*6*	20	*6*	26	*6*	27	*6*	22	*6*
BIOTIC INDEX	2.67	*6*	4.35	*2*	4.87	*2*	5.36	*2*	4.92	*2*	4.83	*2*
EPT INDEX	6	*6*	6	*6*	6	*6*	5	*4*	7	*6*	5	*4*
EPT/CHIRONOMIDAE	9.43	*6*	0.78	*0*	4.83	*2*	0.43	*0*	1.19	*0*	2.33	*2*
SCRAPERS/FILTERERS	1.11	*6*	0.39	*4*	0.43	*0*	0.26	*2*	0.59	*6*	4.92	*0*
% DOMINANT TAXON	35%	*2*	15%	*6*	28%	*4*	15%	*6*	15%	*6*	25%	*4*
TOTAL METRIC SCORE		*32*		*24*		*20*		*20*		*26*		*18*
% COMPARABILITY TO REFERENCE STATION			75%		63%		63%		81%		56%	
BIOLOGICAL CONDITION -DEGREE IMPAIRMENT	REFERENCE		SLIGHTLY IMPACTED		SLIGHTLY IMPACTED		SLIGHTLY IMPACTED		NON/ SLIGHTLY IMPACTED		SLIGHTLY IMPACTED	

Table A4. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Mystic River sub-basin on 9 July 1999. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (NE09), and the corresponding assessment designation for each biomonitoring station. Refer to Table 1 for a complete listing and description of sampling stations.

STATION #	**NE09**		**AR01**		**MI01**	
STREAM	Hawes Brook		Aberjona River		Mill Brook	
HABITAT SCORE	131		132		99	
TAXA RICHNESS	18	*6*	14	*0*	25	*6*
BIOTIC INDEX	4.93	*6*	6.13	*4*	7.50	*2*
EPT INDEX	7	*6*	2	*0*	0	*6*
EPT/CHIRONOMIDAE	7.89	*6*	10.33	*0*	0.00	*6*
SCRAPERS/FILTERERS	0.11	*6*	0.00	*0*	0.10	*6*
% DOMINANT TAXON	25%	*4*	39%	*0*	19%	*6*
TOTAL METRIC SCORE		*34*		*16*		*20*
% COMPARABILITY TO REFERENCE STATION			47%		59%	
BIOLOGICAL CONDITION -DEGREE IMPAIRMENT	REFERENCE		MODERATELY IMPACTED		SLIGHTLY IMPACTED	

Table A5. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Weymouth/Weir River sub-basin on 8 July 1999. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (NE09), and the corresponding assessment designation for each biomonitoring station. Refer to Table 1 for a complete listing and description of sampling stations.

STATION #	**NE09**		**MR01**		**SR01**		**WR01**	
STREAM	Hawes Brook		Monatiquot River		Old Swamp River		Weir River	
HABITAT SCORE	131		128		147		143	
TAXA RICHNESS	18	*6*	12	*6*	24	*6*	24	*6*
BIOTIC INDEX	4.93	*6*	5.19	*6*	5.19	*6*	5.14	*6*
EPT INDEX	7	*6*	[illegible]	*6*	0	*0*	6	*4*
EPT/CHIRONOMIDAE	7.89	*6*	13.00	*6*	1.35	*0*	1.73	*6*
SCRAPERS/FILTERERS	0.11	*6*	0	*6*	5.14	*0*	1.11	*6*
% DOMINANT TAXON	25%	*4*	43%	*6*	24%	*0*	17%	*6*
TOTAL METRIC SCORE		*34*		*16*		*22*		*28*
% COMPARABILITY TO REFERENCE STATION			47%		65%		82%	
BIOLOGICAL CONDITION -DEGREE IMPAIRMENT	REFERENCE		MODERATELY **IMPACTED**		SLIGHTLY IMPACTED		NON/ SLIGHTLY **IMPACTED**	

Table A6. Habitat assessment summary for macroinvertebrate biomonitoring stations sampled during the 1999 Boston Harbor watershed survey. For primary parameters, scores ranging from 16-20 = optimal; 11-15 = suboptimal; 6-10 = marginal; 0-5 = poor. For secondary parameters, scores ranging from 9-10 = optimal; 6-8 = suboptimal; 3-5 = marginal; 0-2 = poor. Refer to Table 1 for a complete listing and description of sampling stations.

STATION	NE09	5B01	BB01	BM01	MB01	NE12	PB01	SB01	9BOB	AR01	MI01	MR01	SR01	WR01
PRIMARY PARAMETERS (range is 0-20)														
INSTREAM COVER	11	14	14	18	5	17	18	18	17	13	2	10	7	8
EPIFAUNAL SUBSTRATE	19	19	18	18	11	17	19	19	19	18	16	18	16	13
EMBEDDEDNESS	13	19	20	19	19	19	18	19	20	19	15	18	17	17
CHANNEL ALTERATION	13	19	19	13	19	10	20	13	18	14	14	7	16	16
SEDIMENT DEPOSITION	17	19	19	17	14	19	18	16	20	7	7	15	14	7
VELOCITY-DEPTH COMBINATIONS	9	9	10	17	7	16	11	17	15	13	8	10	8	8
CHANNEL FLOW STATUS	16	16	19	17	8	19	18	16	17	17	5	14	19	19
SECONDARY PARAMETERS (range is 0-10 for each bank)														
BANK VEGETATIVE PROTECTION	9 8	10 8	10 10	9 10	10 10	9 10	10 10	9 10	9 10	8 8	10 6	6 10	10 10	10 10
BANK STABILITY	7 7	10 8	10 10	9 9	10 10	8 4	10 10	6 10	9 10	7 6	9 5	7 8	8 8	8 9
RIPARIAN VEGETATIVE ZONE WIDTH	1 1	10 7	10 10	10 10	10 10	1 3	9 10	6 10	9 10	1 1	1 1	1 4	7 7	9 9
TOTAL SCORE	**131**	**168**	**179**	**176**	**143**	**152**	**181**	**169**	**183**	**132**	**99**	**128**	**147**	**143**

Table A7. Fish population data collected by DWM at nine biomonitoring stations in the Neponset River sub-basin between 27 and 29 July 1999. Sampling stations were at: Hawes Brook (NE09); Traphole Brook (5B01); Massapoag Brook (9BOB); Beaver Brook (BB01); Beaver Meadow Brook (BM01); Mill Brook (MB01); East Branch Neponset River (NE12); Pequit Brook (PB01); and the unnamed tributary to Steep Hill Brook (SB01). Young-of-the-year fish are noted in parentheses. Refer to Table 1 for a complete listing and description of sampling stations.

TAXON		NE09	5B01	9BOB	BB01	BM01	MB01	NE12	PB01	SB01
Salmonidae										
brown trout	*Salmo trutta*	-	14(33)	-	1	-	-	-	-	-
brook trout	*Salvelinus fontinalis*	-	12(17)	-	-	-	22	-	-	-
Cyprinidae										
spottail shiner	*Notropis hudsonius*	-	-	-	-	-	-	1	-	-
fallfish	*Semotilus corporalis*	11(12)	-	1	-	1	-	13	-	-
golden shiner	*Notemigonus crysoleucas*	-	-	1		1				
Catostomidae										
white sucker	*Catostomus commersoni*	(12)	-	2	(1)	(15)	-	-	(1)	(6)
Percidae										
yellow perch	*Perca flavescens*	-	-	-	-	(1)	-	-	-	-
tesselated darter	*Etheostoma olmstedi*	-	-	-	-	1	10	-	-	-
Ictaluridae										
yellow bullhead	*Ameiurus natalis*	-	-	-	-	-	-	2	-	-
brown bullhead	*Ameiurus nebulosus*	-	-	12	-	1(72)	-	-	2(2)	-
Anguillidae										
American eel	*Anguilla rostrata*	6	-	3	-	3	-	5(1)	(1)	2
Esocidae										
chain pickerel	*Esox niger*	-	-	-	-	-	4	-	-	(1)
redfin pickerel	*Esox americanus*	-	-	-	1	1	6(2)	-	2(1)	-
Centrarchidae										
largemouth bass	*Micropterus salmoides*	(15)	-	1(2)	(1)	(8)	(1)	(2)	(19)	1(7)
bluegill	*Lepomis macrochirus*	2(1)	-	11	-	-	-	3	2(1)	
pumpkinseed	*Lepomis gibbosus*	-	-	8	-	2	-	1	-	4(15)
redbreast sunfish	*Lepomis auritis*	-	-	-	-	-	-	5	-	-
black crappie	*Pomoxis nigromaculatus*	-	-	-	-	-	-	1(2)	(5)	-

APPENDIX D – DEP 1999 GRANT AND LOAN PROGRAMS

Excerpted from the DEP/DWM World Wide Web site,
http://www.state.ma.us/dep/brp/wm/wmpubs.htm#other
'1999 Grant and Loan Programs - Opportunities for Watershed Planning and Implementation'.

604(b) WATER QUALITY MANAGEMENT PLANNING GRANT PROGRAM

This grant program is authorized under the federal Clean Water Act Section 604(b) for water quality assessment and management planning. 604(b) projects in the Boston Harbor Watershed include:

- 98-01/604 *Urban Watershed Management in the Mystic River Basin.* The project will provide recommendations for reducing pollutant runoff into Spy Pond based on a detailed analysis of land cover in watershed. Baseline water quality information, data gaps, and nonpoint source issues will be identified in the Horn Pond watershed. Dry and wet weather water quality sampling will be conducted in Horn Pond watershed. A detailed assessment of the drainage area that contributes runoff for the one large stormwater outfall in Horn Pond will be conducted. Recommendations will be provided to improve stormwater management in the Horn Pond watershed including opportunities for stormwater remediation and future grant funding.

104(b) (3) WETLANDS AND WATER QUALITY GRANT PROGRAM

This grant program is authorized under the wetlands and Clean Water Act Section 104(b)(3) of the federal Clean Water Act. The water quality proposals received by DEP under this National Environmental Performance Partnership Agreement (NEPPA) with the U.S. Environmental Protection Agency is a results oriented approach that will focus attention on environmental protection goals and the efforts to achieve them. The goals of the NEPPA are to: 1) achieve clean air, 2) achieve clean water, 3) protect wetlands, 4) reduce waste generation, and 5) cleanup waste sites. 104 (b) (3) grants in the Boston Harbor watershed include:

- 98-04/104 *Prioritizing Stormwater Enforcement Efforts; A Multi-Watershed Study.* Stormwater is believed to the most significant cause of water quality standard violations. In this study, stormwater will be sampled and analyzed for Fecal coliform and total coliform as well as four other indicators (E. Coli, Enterococci, clostridium perfringens and coliphages) in three watersheds; Charles, Merrimack and Neponset. The four indicators will be used to confirm that the source of high fecal coliform levels is not plant or soil related.

319 NONPOINT SOURCE GRANT PROGRAM

This grant program is authorized under Section 319 of the CWA for implementation projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution. In order to be considered eligible for funding projects must: implement measures that address the prevention, control, and abatement of NPS pollution; target the major source(s) of nonpoint source pollution within a watershed/subwatershed; have a 40 percent non-federal match of the total project cost (match funds must meet the same eligibility criteria as the federal funds); contain an appropriate method for evaluating the project results; address activities that are identified in the Massachusetts NPS Management Program Plan.

- 98-07/319 *Reducing Stormwater in Ultra-Urban Watershed.* The overall objective of this project is to improve the water quality of Alewife Brook by treating and reducing stormwater discharges and developing recommendations for meeting stormwater goals in an ultra urban watershed. Elimination of combined sewer overflows (CSOs) to Alewife Brook is currently being completed. Modeling done by the MWRA has predicted that even with the elimination of the CSOs Alewife Brook will not meet Class B water quality standards due to storm water discharges.
- 99-05/319 *Telecom city.* The project is part of a larger effort to redevelop a 200+ acre Brownfield site along the Malden River where the cities of Malden, Medford and Everett meet. The focus of this project is to migrate stormwater impacts to banks, buffers and surface water quality within the Malden River Corridor by implementing stormwater BMP's, and to develop data on the effectiveness of those BMP's at a difficult urban redevelopment site. The proponent's goal is to put the "environmental portion" of the larger redevelopment project, such as public recreational open space, stormwater

controls and wetlands rehabilitation, in place before the proposed industrial redevelopment of the site begins and overrides environmental concerns.

- 01-06/319 *Memorial Pond Phase I Restoration*. (Neponset)
  The project is the first phase of a larger plan to rehabilitate Memorial Pond in Walpole. Storm water BMPs (sediment forebays followed by constructed wetlands or extended swales/detention ponds) will be built at two storm water discharges (Stone Street and East & Diamond Streets) that were identified in *Memorial Pond Investigation and Management Plan* (1999) as major sources of sediments and nutrients to the Pond. This will result in measurable reduction in sediment and nutrient loading to Memorial Pond prior to undertaking a planned dredging project to remove sediments and nuisance aquatic vegetation in the pond. Nonpoint source pollutant inputs will be addressed first to help ensure that repeated dredging is not required. The outlet to the pond will also be rebuilt to allow future drawdowns needed to control nuisance aquatic vegetation.
- 01-24/319 Storm *water Residuals Reuse Demonstration*
  Storm water runoff is negatively impacting the natural and recreational resources at Wollaston Beach. Chronic bacteria problems cause frequent swimming advisories and have a negative impact on surrounding marsh areas. Storm water from eight outfalls discharge directly onto Wollaston Beach. The City has developed a five-year capital plan to restore water quality at Wollaston Beach. The plan includes eliminating sources of pollution by upgrading sewer and storm drains. The project seeks to obtain a Beneficial Use Determination (BUD) for catch basin residuals. Disposal of catch basin residuals is a statewide problem that will grow more serious with the onset of Phase II Storm water requirements, and development of a BUD is seen as the first step toward solving the problem on a statewide basis. Anticipated results include development of guidelines for other cities and towns seeking to use a similar strategy for disposal of this material. Ideally, the quality of catch basin residuals can be related to land use surrounding the catch basin, enabling development of a set of standard land use-based protocols.

MASSACHSUETTS WATERSHED INITIATIVE PROJECT

- 99-02/MWI *Boston Harbor Hydrologic and Water Quality Investigations*. The purpose of this project is to conduct hydrologic investigations and water quality sampling in support of assessment activities of the Boston Harbor Watershed Team. The information collected will be used to assess water quality conditions in the Mystic, Neponset and Weymouth and Weir River Basins of the Boston Harbor Watershed.
- 00-07/MWI *Boston Harbor Hydrologic and Water Quality Investigations*. This project will conduct water quality, biological and hydrologic investigations at selected locations in the Neponset and Mystic Rivers.
- 02-01/MWI *Alewife Brook Action Plan*
  This project will catalog information to assess water quality conditions in and near Alewife Brook and downstream impacts to the Mystic River and prepare an Action Plan that prioritizes issues and concerns and sets forth a schedule for action.
- 02-02/MWI *Boston Harbor Water Quality Monitoring*
  This project will conduct water quality monitoring in the Boston Harbor Watershed to assess water quality conditions and designated uses.

SOURCE WATER AND TECHNICAL ASSISTANCE/LAND MANAGEMENT GRANT PROGRAM

The Source Water Protection Technical Assistance/Land Management Grant Program provides funds to *third party* technical assistance organizations that assist public water suppliers in protecting local and regional ground and surface drinking water supplies.

- 99-04/SWT *Aaron Reservoir & Lily Pond Source Water Protection Project*. This project will develop a Surface Water Supply Protection Plan to protect the Aaron River Reservoir and Lily Pond watersheds. Lily Pond is a sole source supply of drinking water for Cohasset and serves over 7,000 residents. The development and implementation of this protection plan will significantly enhance the protection of the pond by providing full understanding of the sources and pathways of contamination, and provide a strategy to effectively prevent them from contaminating the water supply.

- 99-06/SWT *Cambridge Watershed Protection Business Partnership Development.* This project will inventory businesses in the Waltham area as well as the existing storm water structures; determine the amount of impervious area on the business' properties; and conduct educational programs detailing inexpensive storm water pollution prevention measures that could be applied to help protect.

WELLHEAD PROTECTION GRANT PROGRAM

The Wellhead Protection Grant Program provides funds to assist public water suppliers in addressing wellhead protection through local projects and education.

- One of Stoughton's largest water supplies is also closest to the industrial area of the town and may be threatened by contaminated groundwater. Numerous monitoring wells have already been installed in the area where possible sources of contamination may exist. This project will expand the monitoring program through the installation of additional monitoring wells to better understand the groundwater flow and to better evaluate the risk of the well becoming contaminated.

99-04/WRBP Mill Brook Wetlands Restoration in the Mystic River Subwatershed

Drinking Water State Revolving Loan Fund for Horn Pond Water Treatment Plant in the Mystic River Subwatershed—construction of a new 6.0 MGD water treatment plant which will include chemical storage and feed facilities to treat Horn Pond Wellfield

Drinking Water State Revolving Loan Fund for Broadway Treatment upgrade

Clean Water State Revolving Loan Fund—rehab of 72" stormwater outfall and construction of new outfall (K. Brander)

APPENDIX E - DMF SHELLFISH DATA, BOSTON HARBOR WATERSHED

It is the mission of the Division of Marine Fisheries (DMF) to manage, develop, and protect the Commonwealth's renewable living marine resources to provide the greatest public benefit. DMF fosters protection of the marine environment by cooperating with other state and federal agencies on pollution abatement, coastal wetlands protection and other programs concerning coastal waters and marine life. DMF monitors coastal contaminant levels in fish and shellfish, operates a shellfish depuration facility, and evaluates the impacts of coastal development on marine fish and their habitats. DMF provides assistance to local shellfish officers on matters affecting the management of shellfish, and provides expertise on anadromous fish and construction assistance on fishways. Other DMF programs assist commercial and recreational fishermen and educate the public on marine resource issues and values.

The DMF Shellfish Management Program manages shellfish growing areas in compliance with the National Shellfish Sanitation Program (NSSP). The NSSP is a federal/state cooperative program recognized by the U.S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC). One goal of this program is the sanitary control of shellfish harvested and sold for human consumption. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (six different classification types in all) with respect to shellfish harvest (Tables E1). Shellfish growing area classifications by subwatershed are provided in Tables E3-E6. Designated shellfish growing areas (as of October 2000) may be viewed using the MassGIS datalayer available from MassGIS at http://www.state.ma.us/mgis/dsga.htm.

Table E1. DMF Shellfish Management Program Managed Shellfish Growing Area Classifications.

Classification Type	Definition
Approved	Open for harvest of shellfish for direct human consumption.
Conditionally Approved	During the time the area is approved, it is open for harvest of shellfish for direct human consumption subject to local rules and state regulations.
Conditionally Restricted	During the time the area is restricted, it is only open for the harvest of shellfish with depuration subject to local rules and state regulations.
Restricted	Open for harvest of shellfish with depuration subject to local rules and state regulations for the relay of shellfish.
Management Closure	Closed for the harvest of shellfish. Not enough testing has been done in the area to determine whether it is fit for shellfish harvest or not.
Prohibited	Closed for the harvest of shellfish.

Classification area codes and town names identify each DMF shellfish area. The Boston Harbor Watershed 1999 Water Quality Assessment Report describes each shellfishing area by its classification area code and the assessed region is defined in square miles within the DEP/DWM water body system segment. As of October 2000 DMF classified a total of 59,933.54 acres in the Boston Harbor Watershed (Table E2).

Table E2. Summary Shellfish Classification Area Information as of October 2000.

Classification Type	Area (acres)
Approved	1.887
Conditionally Restricted	2502.14
Management Closure	12870.147
Prohibited	44559.36

Table E3. Mystic River Subwatershed DMF - Shellfish Project Classification Area Information as of October 2000.

Town	Classification Area Code	Classification Type	Area (Acres)
Boston	GBH4.0	Prohibited	1027.15
Boston	GBH5.0	Prohibited	1128.711
Boston	GBH5.10	Prohibited	12.012
Boston	GBH5.11	Prohibited	42.108
Boston	GBH5.2	Conditionally Restricted	99.9
Boston	GBH5.3	Conditionally Restricted	105.987
Boston	GBH5.4	Conditionally Restricted	70.179
Boston	GBH5.6	Prohibited	14.968
Boston	GBH5.8	Prohibited	37.167
Boston	GBH5.9	Prohibited	12.704
Boston	GBH6.0	Prohibited	1038.58
Boston	MB13.0	Management Closure	76.79
Boston	N27.0	Prohibited	0.016
Boston	N28.0	Prohibited	603.809
Chelsea	GBH4.0	Prohibited	175.787
Everett	GBH4.0	Prohibited	101.483
Revere	GBH4.0	Prohibited	32.174
Revere	GBH5.8	Prohibited	16.479
Revere	N26.0	Prohibited	447.195
Revere	N26.2	Prohibited	97.183
Winthrop	GBH5.0	Prohibited	400.129
Winthrop	GBH5.1	Conditionally Restricted	107.075
Winthrop	GBH5.12	Prohibited	12.362
Winthrop	GBH5.2	Conditionally Restricted	82.489
Winthrop	GBH5.5	Conditionally Restricted	80.593
Winthrop	GBH5.6	Prohibited	3.132
Winthrop	GBH5.8	Prohibited	29.262
Winthrop	N25.0	Prohibited	114.169
Winthrop	N26.0	Prohibited	211.966
Winthrop	N26.2	Prohibited	100.103
Winthrop	N27.0	Prohibited	857.57

Table E4. Neponset River Subwatershed DMF - Shellfish Project Classification Area Information as of October 2000.

Town	Classification Area Code	Classification Type	Area (Acres)
Boston	GBH3.0	Prohibited	189.045
Boston	GBH3.3	Prohibited	1.656
Boston	GBH3.4	Prohibited	49.735
Milton	GBH3.0	Prohibited	99.322
Quincy	GBH3.0	Prohibited	46.226
Quincy	GBH3.3	Prohibited	10.876
Quincy	GBH3.4	Prohibited	79.716

Table E5. Weymouth & Weir Subwatershed DMF - Shellfish Project Classification Area Information as of October 2000.

Town	Classification Area Code	Classification Type	Area (Acres)
Boston	GBH2.0	Prohibited	78.417
Boston	GBH3.0	Prohibited	492.07
Boston	GBH6.0	Prohibited	99.361
Boston	MB13.0	Management Closure	0.13
Braintree	GBH1.0	Prohibited	44.537
Braintree	GBH1.21	Prohibited	43.119
Cohasset	MB9.0	Approved	1.567
Cohasset	MB9.1	Prohibited	0.413
Hingham	GBH1.0	Prohibited	1736.51
Hingham	GBH1.11	Conditionally Restricted	51.659
Hingham	GBH1.14	Conditionally Restricted	69.361
Hingham	GBH1.15	Prohibited	22.566
Hingham	GBH1.17	Prohibited	31.82
Hingham	GBH1.19	Prohibited	33.667
Hingham	GBH1.28	Prohibited	19.363
Hingham	GBH1.29	Conditionally Restricted	0.001
Hingham	GBH1.5	Conditionally Restricted	0.877
Hingham	GBH1.6	Prohibited	33.39
Hingham	GBH1.7	Conditionally Restricted	79.288
Hingham	GBH1.8	Conditionally Restricted	325.11
Hingham	GBH1.9	Conditionally Restricted	51.615
Hull	GBH1.0	Prohibited	2159.914
Hull	GBH1.1	Conditionally Restricted	53.026
Hull	GBH1.17	Prohibited	0.091
Hull	GBH1.2	Conditionally Restricted	119.913
Hull	GBH1.3	Conditionally Restricted	99.988
Hull	GBH1.4	Conditionally Restricted	22.777
Hull	GBH1.5	Conditionally Restricted	76.811
Hull	GBH1.6	Prohibited	35.433
Hull	GBH1.7	Conditionally Restricted	0.007
Hull	GBH2.0	Prohibited	897.525
Hull	GBH6.0	Prohibited	920.485
Hull	GBH6.1	Prohibited	83.67
Hull	MB12.0	Prohibited	6199.622
Hull	MB13.0	Management Closure	4088.56
Hull	MB9.0	Approved	0.32
Hull	MB9.1	Prohibited	0.008
Quincy	GBH1.0	Prohibited	940.104
Quincy	GBH1.22	Prohibited	20.97
Quincy	GBH1.23	Conditionally Restricted	72.691
Quincy	GBH1.24	Prohibited	10.37
Quincy	GBH1.25	Conditionally Restricted	99.484
Quincy	GBH1.26	Conditionally Restricted	71.695
Quincy	GBH1.27	Management Closure	58.404
Quincy	GBH1.31	Conditionally Restricted	2.957
Quincy	GBH2.0	Prohibited	3605.944
Quincy	GBH2.1	Conditionally Restricted	192.025
Quincy	GBH2.2	Conditionally Restricted	120.257

Table E5. (Continued) Weymouth & Weir Subwatershed DMF - Shellfish Project Classification Area Information as of October 2000.

Town	Classification Area Code	Classification Type	Area (Acres)
Quincy	GBH2.3	Prohibited	156.68
Quincy	GBH2.4	Prohibited	89.597
Quincy	GBH2.5	Conditionally Restricted	126.525
Quincy	GBH2.6	Prohibited	17.465
Quincy	GBH2.7	Prohibited	11.602
Quincy	GBH3.0	Prohibited	518.54
Quincy	GBH3.1	Prohibited	49.755
Quincy	GBH3.2	Conditionally Restricted	79.276
Weymouth	GBH1.0	Prohibited	1953.289
Weymouth	GBH1.10	Conditionally Restricted	83.554
Weymouth	GBH1.11	Conditionally Restricted	0.028
Weymouth	GBH1.13	Conditionally Restricted	74.279
Weymouth	GBH1.14	Conditionally Restricted	0
Weymouth	GBH1.15	Prohibited	49.753
Weymouth	GBH1.16	Prohibited	26.258
Weymouth	GBH1.18	Prohibited	56.805
Weymouth	GBH1.20	Conditionally Restricted	26.203
Weymouth	GBH1.21	Prohibited	124.044
Weymouth	GBH1.29	Conditionally Restricted	53.885
Weymouth	GBH1.9	Conditionally Restricted	2.625

Table E6. Boston Harbor Proper DMF - Shellfish Project Classification Area Information as of October 2000.

Town	Classification Area Code	Classification Type	Area (Acres)
Boston	GBH2.0	Prohibited	1558.027
Boston	GBH3.0	Prohibited	1354.887
Boston	GBH6.0	Prohibited	3263.018
Boston	MB13.0	Management Closure	8646.263
Boston	N28.0	Prohibited	6393.052

APPENDIX F. LANDFILLS IN THE BOSTON HARBOR WATERSHED

The following landfill data was obtained from the Massachusetts Department of Environmental Protection Bureau of Waste Prevention is available on the MA DEP website (http://www.state.ma.us/dep/bwp/dswm/dswmpubs.htm#swfd). This information is also available as a datalayer from Mass-GIS (http://www.state.ma.us/mgis/sw.htm). There are 99 landfills within the Boston Harbor Watershed, located through out the Mystic, Neponset, Weymouth and Weir, and Boston Harbor Proper subwatersheds.

Currently there are seven un-mapped landfills within the Boston Harbor watershed:

Arlington Landfill, Concord Turnpike
Burlington Landfill, Location unknown
Cohasset Landfill, Forest Drive
Dedham Landfill, Centre Street
Holbrook Landfill, Smith Lane
Stoneham Landfill, Dale Street / Garey Street
Westwood Landfill, Route 109 / Saint Mary's

Site Name	Address		Capped (Y/N)	Liner	Status	Type	Year Opened	Year Permit Expired	Actual Date of Closure
Abington Landfill	Groveland St	Abington, Ma 02351	Capped	N	Closed	Municipal	1940	1975	
Arlington Landfill	Keats Rd	Arlington, Ma 02174	Not Capped	N	Inactive	Municipal	0	1969	
Arlington Landfill	Summer St/Draelon Rd	Arlington, Ma 02174	Not Capped	N	Inactive	Municipal	1959	1969	
Arlington Landfill	Summer St/Reed Rd				Inactive	Private	0	1987	
Arlington Landfill	Concord Tpk	Arlington, Ma 02174		N	Inactive	Municipal	0	1947	
Arlington Landfill	Berkley St	Arlington, Ma 02174	Not Capped	N	Inactive	Municipal	0	0	
Avon Landfill	Page/Wales Sts	Avon, Ma 02322		N	Inactive	Municipal	0	1975	
Belmont Landfill	1130 Concord Ave	Belmont, Ma 02178	Capped	N	Closed	Private	0	1974	

Site Name	Address		Capped (Y/N)	Liner	Status	Type	Year Opened	Year Permit Expired	Actual Date of Closure
Boston Landfill	Mt Vernon Rd/Mile/Columbia Pt	Dorchester, Ma	Not Capped	N	Inactive	Unknown	0	0	
Boston Landfill	Gardner St	West Roxbury, Ma 02132	Not Capped	N	Inactive	Municipal	1954	1985	
Spectacle Island Landfill	Spectacle Island	Boston, Ma	Partially Capped	N	Inactive	Municipal	1918	1959	
Hallet Street Landfill	Hallet Street Extn	Dorchester, Ma	Not Capped	N	Inactive	State	1948	1966	
Neponset Avenue Landfill	Neponset Ave	Dorchester, Ma	Not Capped	N	Inactive	State	1935	1949	
Barry Quarry	401-453 Cummings Hwy	Hyde Park, Ma 02131	Not Capped	N	Inactive	Private	1984	1990	
Walworth Foundry Landfill	1525 Washington St	Braintree, Ma 02184	Not Capped	N	Inactive	Private	1960	1979	
Braintree Landfill	Brookside Rd	Braintree, Ma 02184		N	Inactive	Unknown	0	0	
Braintree Landfill	Ivory/Union Sts	Braintree, Ma 02184	Capped	N	Closed	Municipal	1950	1983	06/04/93
Brockton Landfill	West Chestnut St	Brockton, Ma	Not Capped	N	Inactive	Municipal	0	1968	
Brockton Landfill	413 Thatcher St	Brockton, Ma 02402		N	Inactive	Municipal	1947	1989	
Brockton Sludge Landfill	303 Oak Hill Way	Brockton, Ma		N	Active	Municipal	0	2000	
Brockton Landfill	Skinner St	Brockton, Ma	Not Capped	N	Inactive	Municipal	0	0	
Burlington Landfill			Not Capped	N	Inactive	Unknown	0	1958	
Burlington Landfill	Muller Rd				Inactive	Municipal	0	1958	
Mooney Street Dump	45 Mooney St	Cambridge, Ma 02138	Not Capped	N	Inactive	Municipal	1938	1955	
WR Grace Sludge Landfill	Harvey St	Cambridge, Ma 02139	Excavated	N	Closed	Private	1960	1979	
New St Landfill (Danehy Park)	New St	Cambridge, Ma 02139	Capped	N	Closed	Municipal	1946	1982	03/29/89
Canton Landfill	Pine St	Canton, Ma 02021	Capped	N	Closed	Municipal	0	1989	
Chelsea Landfill	Marginal St	Chelsea, Ma 02150	Not Capped	N	Inactive	Unknown	0	0	
Chelsea Landfill	Webster St	Chelsea, Ma 02150		N	Inactive	Municipal	0	1956	
Cohasset Landfill	81 Cedar St	Cohasset, Ma 02025	Capped	N	Closed	Municipal	1970	1990	06/07/96
Cohasset Heights Demo Landfill	234 Crocker Ln/Rte 3a	Cohasset, Ma 02025	Partially Capped	Y	Inactive	Private	1978	1998	
Cohasset Landfill	Forest Drive				Inactive	Municipal	0	0	
Dedham Landfill	Centre St				Inactive	Unknown	0	0	
Dedham Landfill	Incinerator Rd/East St/Rte 1	Dedham, Ma 02026	Not Capped	N	Inactive	Municipal	0	1976	
Dover-Westwood Landfill	55 Powissett St	Dover, Ma 02030	Partially Capped	N	Inactive	Municipal	0	1988	
Dover Landfill	Dover Rd				Inactive	Municipal	0	0	
Everett Landfill	2835 Revere Bch Pkwy (Rte 16)	Everett, Ma 02149		N	Inactive	Municipal	0	1963	

Site Name	Address		Capped (Y/N)	Liner	Status	Type	Year Opened	Year Permit Expired	Actual Date of Closure
Foxborough Landfill	East Belcher Rd	Foxborough, Ma 02035	Not Capped	N	Inactive	Municipal	0	1998	04/27/99
Hingham Landfill	Hobart St	Hingham, Ma 02043	Not Capped	N	Inactive	Municipal	1962	2000	09/29/95
Unconfirmed Site	Hobart St	Hingham, Ma 02043		N	Inactive	Unknown	0	0	
Cains Pit Landfill	Spring Ln (Sic Smith Ln)	Holbrook, Ma 02343	Not Capped	N	Inactive	Private	1968	1974	
Holbrook Landfill	Maple Ave (N Franklin St)	Holbrook, Ma 02343	Capped	N	Closed	Municipal	1945	1995	05/23/96
Holbrook Landfill	Smith Lane				Inactive	Municipal	0	0	
Unconfirmed Site	Weymouth St	Holbrook, Ma 02343		N	Inactive	Unknown	0	0	
Hull Landfill	Pocassett St				Inactive	Unknown	0	0	
Hull Landfill	Logan Ave	Hull, Ma 02045	Partially Capped	Y	Active	Municipal	0	2006	11/24/89
Lexington Landfill	Hartwell Ave	Lexington, Ma 02173	Not Capped	N	Inactive	Municipal	1963	1980	
Lexington Dump	Lincoln St	Lexington, Ma 02173	Not Capped	N	Inactive	Municipal	0	1963	
Malden Landfill	Bow/Green St	Malden, Ma	Not Capped	N	Inactive	Unknown	0	0	
Malden Landfill	Maplewood St	Malden, Ma		N	Inactive	Municipal	0	1960	
Medfield Landfill	N Meadows Rd (Fmr Grove St)	Medfield, Ma 02052	Partially Capped	N	Inactive	Municipal	0	1993	
Medfield Sludge Landfill	99 Bridge St				Active	Municipal	0	0	
Medford Landfill	Wellington Circle	Medford, Ma		N	Inactive	Unknown	0	0	
Medford Landfill	Riverside Ave	Medford, Ma		N	Inactive	Municipal	0	0	
Melrose Landfill	Penny Rd/Broadway (Rte 99)	Melrose, Ma	Not Capped	N	Inactive	Municipal	1960	1976	
Milton (ACE) Landfill	750 Randolph Ave (Rte 28)	Milton, Ma 02186	Not Capped	N	Inactive	Private	1961	1998	
Unquity Road Dump (MDC)	Unquity Rd	Milton, Ma 02186	Not Capped	N	Inactive	State	1949	1994	
Norwell Landfill					Inactive	Unknown	0	0	
Norwell Landfill	Pine St/Circuit St	Norwell, Ma 02061	Capped	N	Closed	Municipal	0	1976	12/17/76
Norwell Landfill	Mt Hope St				Inactive	Unknown	0	1976	
Norwood (PCB) Landfill	Dean St/Rte 1	Norwood, Ma		N	Inactive	Unknown	0	0	
Norwood Landfill	Winter/Cemetery Sts	Norwood, Ma 02062	Partially Capped	N	Inactive	Municipal	1945	1996	
Bird Granular Dump	Rte 1/Norwood Park South	Norwood, Ma	Partially Capped	N	Inactive	Private	1930	1971	11/18/82
BFI Quincy Landfill	Willard St/Ricciutti Dr	Quincy, Ma 02169	Capped	N	Closed	Private	0	1987	07/31/87
MWRA WWTP - Nut Island	147 Sea Ave				Inactive	Municipal	0	0	
Quarry Hills Soils Landfill	Ricciutti Dr	Quincy, Ma 02169	Not Capped	Y	Active	Private	1998	2003	
Granite Rail Quarry Landfill	Ricciutti Dr	Quincy, Ma		N	Inactive	Unknown	0	0	

Site Name	Address		Capped (Y/N)	Liner	Status	Type	Year Opened	Year Permit Expired	Actual Date of Closure
Louis Kmito & Son Landfill	2 Johnson Dr	Randolph, Ma 02368	Capped	Y	Closed	Private	1932	1995	11/05/92
Unconfirmed Site	Johns St				Inactive	Unknown	0	0	
Unconfirmed Site	Charles St	Reading, Ma		N	Inactive	Unknown	0	0	
Reading Landfill	Walkers Brook Dr (Johns St)	Reading, Ma 01867	Not Capped	N	Inactive	Municipal	0	1984	
North Revere Landfill	Morris St	Revere, Ma 02151	Capped	N	Closed	Private	1978	1984	06/21/94
Rockland Landfill	Lower Beech St	Rockland, Ma 02370	Capped	N	Closed	Municipal	1976	1995	08/15/97
Old Rockland Landfill	Pleasant St/VFW Dr	Rockland, Ma 02370		N	Inactive	Private	0	1976	
Sharon Landfill	Mountain St	Sharon, Ma 02067	Capped	N	Closed	Municipal	1900	1992	
Stoneham Landfill	Hall Rd/Brookbridge Rd	Stoneham, Ma		N	Inactive	Municipal	0	1970	
Stoneham Landfill	Dale St/Garey St	Stoneham, Ma		N	Inactive	Municipal	0	1946	
Stoughton Landfill	Page St	Stoughton, Ma 02072	Capped	N	Closed	Municipal	0	1976	07/16/76
Wakefield Landfill	371 Salem St	Wakefield, Ma		N	Inactive	Unknown	0	0	
Walpole Demolition Landfill	Norfolk/West St				Inactive	Municipal	0	0	
Unconfirmed Site	Birch St	Walpole, Ma		N	Inactive	Unknown	0	0	
Unconfirmed Site	Robbins Rd	Walpole, Ma		N	Inactive	Unknown	0	0	
Walpole Landfill	Lincoln Rd	Walpole, Ma 02081		N	Inactive	Municipal	1967	1978	
Bird Incorporated Landfill	Norfolk St	Walpole, Ma 02081	Not Capped	N	Inactive	Private	1968	1997	
Walpole Dump	1701-1709 Main St (Rte 1a)	Walpole, Ma 02081	Not Capped	N	Inactive	Municipal	1958	1975	
Unconfirmed Site	Norfolk/West Sts	Walpole, Ma			Inactive	Unknown	0	0	
SCA Landfill	Arlington/Coolidge Hill	Watertown, Ma		N	Inactive	Private	0	0	
Watertown Landfill	Highland Ave/Onley St	Watertown, Ma	Not Capped	N	Inactive	Municipal	0	1961	
Watertown Bemis Dump	Pleasant St	Watertown, Ma		N	Inactive	Municipal	0	1965	
Watertown Landfill	166 Grove St	Watertown, Ma	Capped	N	Closed	Municipal	0	1975	
Watertown Landfill	Bemis St				Inactive	Municipal	0	0	
B F Goodrich Landfill	Coolidge Ave	Watertown, Ma 02172		N	Inactive	Private	1964	1982	
Westwood Landfill	Rte 109/St Marys	Westwood, Ma 02090		N	Inactive	Municipal	0	0	
Weymouth Landfill	Main/Washington Sts	Weymouth, Ma 02189	Not Capped	N	Inactive	Municipal	1924	1949	
Weymouth Landfill	95 Wharf St	Weymouth, Ma 02189	Not Capped	N	Inactive	Municipal	1949	1977	
Winchester Landfill	115 Swanton St/Mckay Ave	Winchester, Ma 01890	Not Capped	N	Inactive	Municipal	0	1976	
Unconfirmed Site	Morton St/Short Island Beach				Inactive	Unknown	0	0	

Site Name	Address	Capped (Y/N)	Liner	Status	Type	Year Opened	Year Permit Expired	Actual Date of Closure
Winthrop Landfill	Argyle St Winthrop, Ma	Not Capped	N	Inactive	Municipal	0	1975	
Woburn Landfill	Merrimac St/New Boston Woburn, Ma 01801	Not Capped	N	Inactive	Municipal	1966	1986	

APPENDIX G – SUMMARY OF WMA PERMITTING INFORMATION, BOSTON HARBOR WATERSHED

Table G1. List of WMA registered and permitted average annual water withdrawals in the Boston Harbor Watershed (LeVangie, D. 2001. Water Management Act Database. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Database Manager. Boston, MA.).

Segment	Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	Well/Source Name	Withdrawal Location
			3010000	Arlington Water Dept.			-01P	MWRA	
			3026000	Belmont Water Dept.			-01P	MWRA	
			3035000	Boston Water & Sewer Comm			-01P	MWRA	
			3040000	Braintree Water Dept.			-01P	MWRA	
				Braintree Water Dept.			-01T	Great Pond WTP	Blue Hills
MA 74-07		34904001	3040000	Braintree Water Dept.	3.87	0	-01S	Great Pond	Blue Hills
MA 74-07		34904001	3040000	Braintree Water Dept.	3.87	0	-02S	Richardi Reservoir	Blue Hills
MA 74-07				Braintree Water Dept.			-03S	Farm River	Blue Hills
MA 74-07				Braintree Water Dept.			-04S	Upper Reservoir- Great Pond	Blue Hills
				Braintree Water Dept.			-01G	Lakeside Dr. G. P. Well	Blue Hills
			304001	Del's Poultry Farm			-01G		Braintree
			3048000	Burlington Water Dept.			-04G	Wyman Tubular Wells #8	Lexington
			3049000	Cambridge Water Dept.			-02T	Fresh Pond WTP	Lexington
				Cambridge Water Dept.			-02S	Fresh Pond Reservoir	Lexington
			3050000	Canton Water Dept.			-01P	MWRA	
				Canton Water Dept.			-01G	Washington St. G.P. Well #1	Blue Hills
				Canton Water Dept.			-02G	Henry's Spring dug well	Blue Hills
MA 73-20				Canton Water Dept.			-03G	Springdale Dug & Tub well	Norwood
MA 73-05				Canton Water Dept.			-04G*	Dedham St. G.P. Well #2	Norwood
MA 73-05				Canton Water Dept.			-05G*	Dedham St. G.P. Well #3	Norwood

*indicates permitted withdrawal for less than 365 days, ** indicates registered withdrawal for less than 365 days, G – ground water, S – surface water, P-Public, T-Transient

Table G1. Continued. List of WMA registered and permitted average annual water withdrawals in the Boston Harbor Watershed (LeVangie 2001).

Segment	Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	Well/Source Name	Withdrawal Location
	9P31905001		3050000	Canton Water Dept.	0	2.43	-06G	Pecunit G.P. Well #4	Norwood
	9P31905001			Canton Water Dept.	0	2.43	-07G	Forest Ave. G.P. Well #5	Norwood
				Canton Water Dept.			-08G	Forest Ave G. P. Well #6	Norwood
MA 73-05				Canton Water Dept.			-09G	Neponset G.P. Well #7	Norwood
MA 73-05	9P31905001		3050000	Canton Water Dept.	0	2.43	-10G*	Forest Ave. G.D> Well #10	Norwood
							-0AG	South Arm Well	Norwood
			3057000	Chelsea Water Dept.				MWRA	
			3073000	Dedham/Westwood Wat. Dist			-01T	White Lodge GWTP	Norwood
MA 73-02	9P31907301	31907301	3073000	Dedham/Westwood Wat. Dist	2.62	0.49	-06G*	White Lodge G.P. Well #1	Norwood
MA 73-02	9P31907301	31907301	3073000		2.62	0.49	-07G*	White Lodge G.P. Well #2	Norwood
MA 73-02	9P31907301	31907301	3073000	Dedham/Westwood Wat. Dist	2.62	0.49	-08G*	White Lodge G. P. Well #3	Norwood
MA 73-02	9P31907301	31907301	3073000	Dedham/Westwood Wat. Dist	2.62	0.49	-09G*	White Lodge G. P. Well #4	Norwood
MA 73-02				Dedham/Westwood Wat. Dist			-13G*	White Lodge G. P. Well #5	Norwood
	9P231907801		3078006	Dover Water Co.		0.14	-01G	Walpole St. Wells	Medfield
MA 73-07	9P231907801		3078006	Dover Water Co.		0.14	-04G*	Draper RD. Well #1	Medfield
MA 73-07	9P231907801		3078006	Dover Water Co.		0.14	-05G*	Draper Rd. Well #2	Medfield
			3078007	Dover Water Works			-01P	Dover Water Co. Supply	
			3093000	Everett Water Dept.			-01P	MWRA	
			3131000	MA Am. Wat. CO (Hingham)			-02T	Free St. #2 Filter Plant	Weymouth
				MA Am. Wat. CO (Hingham)			-03T	Fulling Mill Filter Plant	Weymouth
				MA Am. Wat. CO (Hingham)			-04T	George W. Johnstone WTP	Weymouth
		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-01S	Accord Pond	Weymouth

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Table G1. Continued. List of WMA registered and permitted average annual water withdrawals in the Boston Harbor Watershed (LeVangie 2001).

Segment	Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	Well/Source Name	Withdrawal Location
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-02S	Accord Brook	Cohasset
MA 74-02				MA Am. Wat. CO (Hingham)			-03S	Fulling Mill Coll Basins	Weymouth
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-01G	Free St. G.P. Well #1	Weymouth
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-02G	Free St. G.P. Well #2	Weymouth
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-03G	Scotland St. G.P. Well	Cohasset
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-04G	Downing St. G.P. Well	Weymouth
MA 74-02		31913101	3131000	MA Am. Wat. CO (Hingham)	3.51	0	-05G	Free St. G.P. Well #3	Weymouth
MA 74-02				MA Am. Wat. CO (Hingham)			-08G	Free St. Well #4	Weymouth
			3131003	Nino's Steak and Chops			-01G		Hingham
			3133000	Holbrook Water Dept.			-01P	Randolph/Holbrook Supply	
			3165000	Malden Water Div.			-01P	MWRA	
MA 73-09		3197501	3175000	Medfield Water Dept.	0.92	0	-03G*	Elm St. G.P. Well #3	Medfield
MA 73-09		3197501	3175000	Medfield Water Dept.	0.92	0	-04G*	Elm St. G.P. Well #4	Medfield
			3176000	Medford Water Dept.			-01P	MWRA	
			3178000	Melrose Water Dept.			-01P	MWRA	
			3189000	Milton Water Dept			-01P	MWRA	
			3189001	Copeland Properties, Inc.			-02G		Milton
				Copeland Properties, Inc.			-01G		Milton
			3220000	Norwood Water Dept.			-01P	MWRA	
				Norwood Water Dept.			-01T	Ellis GWTP	Norwood
				Norwood Water Dept.			-01G	Ellis G.P. Well #1	Norwood
				Norwood Water Dept.			-02G	Ellis G.P. Well #2	Norwood
				Norwood Water Dept.			-03G	Buckmaster Pond G.P. Well	Norwood
				Norwood Water Dept.			-04G	Ellis Tubular Wells	Norwood

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Table G1. Continued. List of WMA registered and permitted average annual water withdrawals in the Boston Harbor Watershed (LeVangie 2001).

Segment	Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	Well/Source Name	Withdrawal Location
			3423000	Quincy Water Dept			-01P	MWRA	
			3244000	Randolph water Dept			-01P	Randolph/Holbrook Supply	
			3244001	Randolph/Holbrook Wat. Dist			-01P	MWRA	
				Randolph/Holbrook Wat. Dist			-01T	Great Pond WTP	Blue Hills
MA 74-07		31913301	3133000	Randolph/Holbrook Wat. Dist	3.27	0	-01S	Great Pond	Blue Hills
				Randolph/Holbrook Wat. Dist			-02S	Blue Hill River	Blue Hills
				Randolph/Holbrook Wat. Dist			-01G	South St. G.P. Well # 3	Blue Hills
				Randolph/Holbrook Wat. Dist			-02G	South St. G.P. Well # 2	Blue Hills
		31913301	3133000	Randolph/Holbrook Wat. Dist	3.27	0	-03G	South St. G.P. Well # 1	Blue Hills
MA 74-12		31913301	3133000	Randolph/Holbrook Wat. Dist	3.27	0	-04G	Donna Rd. Tubular Wells	Blue Hills
							-0AG	Donna Rd. Well Site	
			3274000	Somerville Water Dept.			-01P	MWRA	
			3284000	Stoneham Water Dept			-01P	MWRA	
			3307000	Walpole Water Dept			-01T	Mine Brook GWTP	Medfield
				Walpole Water Dept			-02T	School Meadow Brook WTF	Norwood
MA 73-10	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-01G*	Mine Brk G.P. Well # 1	Medfield
MA 73-09	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-02G*	Mine Brk. Well # 2	Medfield
MA 73-09	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-03G*	Mine Brk Well # 3	Medfield
				Walpole Water Dept			-04G	Washington St. # 1 Tub Well WF	Norwood
MA 73-06	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-05G*	Washington G.P. Well # 3	Mansfield
MA 73-06	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-06G*	Washington G. P. Well # 2	Norwood
				Walpole Water Dept			-07G	South St. G.P. Well	Wrentham

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Table G1. Continued. List of WMA registered and permitted average annual water withdrawals in the Boston Harbor Watershed (LeVangie 2001).

Segment	Permit	Registration	PWSID	System Name	Registered Volume (MGD)	20 Year Permitted Volume (MGD)	Source	Well/Source Name	Withdrawal Location
MA 73-06	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-08G*	Washington G.P. Well # 5	Norwood
MA 73-06	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-09G*	Washington G.P. Well #6	Mansfield
MA 73-06	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-10G*	Washington G.P. Well # 4	Norwood
MA 73-10	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-11G*	Mine Brk G.P. Well # 5	Medfield
MA 73-01	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-12G*	Neponset P.S. #1 (well 1)	Norwood
MA 73-01	9P31930702	31930701	3307000	Walpole Water Dept	2.25	1.09	-13G*	Neponset P.S. # 1 (well 2)	Norwood
			3336000	Weymouth Water Dept.			-01T	Great Pond WTP	Weymouth
				Weymouth Water Dept.			-02T	Bilodeau (Winter St.) GWTP	Weymouth
		31933601	3336000	Weymouth Water Dept.	4.51	0	-01S	Great Pond	Weymouth
				Weymouth Water Dept.			-02S	Old Swamp Riv. / South Cove	Weymouth
		31933601	3336000	Weymouth Water Dept.	4.51	0	-03S	Whitmans Pond	Weymouth
MA 74-04		31933601	3336000	Weymouth Water Dept.	4.51	0	-01G	Circuit Ave. G.P. Well	Weymouth
MA 74-04		31933601	3336000	Weymouth Water Dept.	4.51	0	-02G	Main St. G.P. Well	Weymouth
MA 74-03				Weymouth Water Dept.			-03G	Libbey Park G.P. Well	Weymouth
MA 74-04				Weymouth Water Dept.			-04G	Winter St. G.P. Well # 1	Weymouth
MA 74-04		31933601	3336000	Weymouth Water Dept.	4.51	0	-05G	Winter St. G.P. Well # 2	Weymouth
			3344000	Winchester Water Dept.			-01P	MWRA (Spot Pond)	
				Winchester Water Dept.			-01T	WTP	Boston North
MA 71-01		31934402	3344000	Winchester Water Dept.	1.06	0	-01S	North Reservoir	Boston North
MA 71-02				Winchester Water Dept.			-02S	Middle Reservoir	Boston North
MA 71-02		31934402	3344000	Winchester Water Dept.	1.06	0	-03S	South Reservoir	Boston North
				Winchester Water Dept.			-01G	Pond Brook Tubular Wells	Lexington
			3347000	Woburn Water Dept			-01P	MWRA	

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				Woburn Water Dept			-01S	Horn Pond	Lexington
MA 71-01		31934703	3347000	Woburn Water Dept	4.07	0	-01G	GP Well A2	Lexington
MA 71-01		31934703	3347000	Woburn Water Dept	4.07	0	-02G	GP Well D	Lexington
MA 71-01				Woburn Water Dept			-03G	GP Well C2	Lexington
MA 71-01		31934703	3347000	Woburn Water Dept	4.07	0	-04G	GP Well B	Lexington
MA71-01				Woburn Water Dept			-05G	DUG Well	Lexington
MA71-01		31934703	3347000	Woburn Water Dept	4.07	0	-06G	GP Well F	Lexington
MA71-01		31934703	3347000	Woburn Water Dept	4.07	0	-07G	GP Well E	Lexington
MA71-01				Woburn Water Dept			-08G	GP Well G	Lexington
MA71-01				Woburn Water Dept			-09G	GP Well H	Lexington
MA71-01				Woburn Water Dept			-10G	GP Well I	Lexington
			6000000	MWRA			-05S	Spot Pond	Boston North
MA73-19			4266000				-03G	GP Well # 4	Norwood
			4219000				-02G	GP Well # 2	Cohasset
							-03G	GP Well # 3	Cohasset
							-05G	GP Well # 5	Cohasset
							-11G	GP Well # 10	Cohasset
			4285000				-06G	Pratts Court Well	Norwood

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